THE COMPARATIVE MORPHOLOGY OF THE ORDER STREPSIPTERA TOGETHER WITH RECORDS AND DESCRIPTIONS OF INSECTS.

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INTRODUCTION.

Since publishing in 1911[1] a number of additional species and new records of the Strepsiptera as a supplement to the Monographic Revision in Bulletin 66 of the United States National Museum, enough new material has been accumulated to occasion this second supplement. It is the expectation of the writer from time to time to continue this series of papers summarizing all the known material on this interesting order of parasitic insects.

Material has been received from T. L. Jones (Porto Rico), N. Kourdumoff (Russia), T. B. Fletcher (India), F. Muir (Hawaii), H. G. Champion (England), J. P. Kryger (Denmark), S. E. Crumb (Tennessee), and H. F. Loomis, R. C. Shannon, and J. C. Crawford (Maryland), and much of interest has been recently found in the new acquisitions of the United States National Museum. Determinations of hosts have very kindly been made by Messrs. Crawford, Rohwer, Viereck, and the late Mr. Heidemann.

A large number of errata and corrections are noted herein. The writer is under obligations to Dr. Karl Hofeneder (Austria) for corrections of many of the errors, specially the bibliographic. The most serious errors occur in the Genera Insectorum in the reference to figures and were due to a recasting of the plates by the editors and the addition of many small figures after the page proofs had been seen. No mention of these figures was made in the text or explanation of plates.

The same headings and letterings of paragraphs are used as in Bulletin 66.

[1] Proc. U. S. Nat. Mus., vol. 40, No. 1834, May 17, 1911, pp. 487–511.

BIOLOGY.

Mr. Austin H. Clark has called the attention of the author to an analogy of the parasitic life of the Strepsiptera to certain of the parasitic crabs. The sea urchin, *Strongylocentrotus gibbosus* is parasitized by a soft shelled crab, *Fabia chilensis*, which enters the host through the anal opening, while a larva, and lives in the alimentary canal as a commensal. It causes a distortion of the shell.

The very degenerate crabs, *Sacculina carcini*, etc., live in the body of other crabs and shrimps.

Mr. Ed. Foster has also called attention to the parasitic isopod, *Probopyrus bithynis* Richardson of the Bopyridae, which is parasitic on shrimps. The female in the final instar is merely a sac of eggs, while the males in this stage are triungulinid form.

RELATIONS TO HOST.

1. *Actual relationship to the host.*

RECORDS BY SPECIES.

ANDRENA NIGROAENEA Kirby.

Smith and Hamm (1914) found at Oxford, England, that the female parasites greatly outnumbered the males. Their records are based upon—

Twenty female bees 4 of which contained male puparia; 16 of which contained females.

Fifteen male bees 4 of which contained male puparia; 10 of which contained females.

The data given do not disclose the actual number of parasites contained in the 35 bees, but it was evidently larger than the number of hosts, as one specimen illustrated contained 3 females.

POLISTES ANAHEIMENSIS Provancher.

Prof. L. Bruner collected a male of this wasp at Auburn, California, July 23, 1915, with a female parasite behind the fifth dorsal sclerite.

POLISTES ANNULARIS Linnaeus.

Mr. L. T. Williams collected a female wasp at Omaha, Nebraska, August 20, 1913, which contained 3 females in the fourth lateral, fourth ventral, and fifth dorsal, and a male exuvium in the fourth ventral segments. The females were full of triungulinids.

Messrs E. G. Anderson and H. A. Jones collected seven parasitized females at Louisville, Nebraska, August 2, 1914. These seven wasps contained 58 parasites, of which 52 were males, one with 11 males, one with 8 males, one with 6 males, one with 5 males, one with 4 males

and 5 females, and two with 4 males. The parasites were located as follows:

Five males protruding from the second segment, dorsal; 5 males protruding from the second segment, lateral; total, 10.

Ten males protruding from the third segment, dorsal; 7 males protruding from the third segment, lateral; 3 males protruding from the third segment, ventral; total, 20.

Five males protruding from the fourth segment, dorsal; 2 males protruding from the fourth segment, lateral; 3 females protruding from the fourth segment, ventral; 2 males protruding from the fourth segment, ventral; one female larva in the fourth segment; total, 13.

Two females protruding from the fifth segment, dorsal; 1 female protruding from the fifth segment, lateral; 2 females protruding from the fifth segment, ventral; total, 5.

The males were all pupae. The largest number of parasites in a single segment was 7 protruding from the third segment of the wasp that had 11 parasites. These were located 4 dorsally, 2 laterally, and 1 ventrally.

POLISTES AURIFER Saussure.

Prof. L. Bruner collected a female wasp at Auburn, California, August 14, 1915, with a female parasite behind the fifth dorsal sclerite. It was full of triungulinids.

POLISTES VARIATUS Cresson.

Mr. S. E. Crumb collected a female on November 10, 1915, at Clarkville, Tennessee, with four empty male puparia, three in the third dorsal and one in the fifth dorsal segment. The contents of the body cavity were very greatly crowded and reduced. On November 24, 1915, Mr. H. F. Lomis at Lanham, Maryland, collected five female wasps, four containing one female each and one with a male pupa. All the females occurred in the fifth dorsal segment, while the male was in the fourth dorsal.

POLISTES BELLICOSUS Cresson.

The writer collected, on August 25, 1913, in the Santa Rita Mountains, Arizona, a female wasp which contained four male puparia, two behind the third dorsal, one behind the fourth dorsal, and one behind the fifth dorsal segment. The wasp's body organs were considerably crowded. The ovaries contained one fully developed egg, and all the others were very small.

ODYNERUS, species.

The writer collected on August 24, 1913, at Tucson, Arizona, a female wasp which contained two female parasites, one behind the third dorsal and the other behind the fourth dorsal segment. Triungulinids were crawling on the wasp's body.

ONCOMETOPIA UNDATA Fabricius.

Mr. George D. Smith collected at Thomasville, Georgia, a female containing two female *Dacyrtocara undata*, one behind the fourth ventral and the other behind the fifth lateral plate. The leaf hopper died in captivity May 10, 1915, and was immediately placed in alcohol. The two parasites completely filled the abdomen, having absolutely emptied and destroyed the intestines, reproductive organs, and all other abdominal organs.

STENOCRANUS SACCHARIVORUS Westwood.

At Rio Piedras, Porto Rico, in November, 1913, Mr. T. H. Jones collected a large number of sugar-cane leaf hoppers, *Stenocranus saccharivorus*, abundantly parasitized by *Stenocranophilus quadratus* Pierce. A total of 150 leaf hoppers were obtained. On these leaf hoppers the following data were made, as tabulated:

Leaf hoppers.	Unparasitized.	Parasitized.
71 male	50	21
79 female	49	30
150	99	51

47.3 per cent of the leaf hoppers were males, 52.7 per cent females.

41.1 per cent of the parasitized leaf hoppers were males, 58.9 per cent females.

70.4 per cent of the male leaf hoppers were unparasitized, 29.6 per cent parasitized.

62 per cent of the female leaf hoppers were unparasitized, 38 per cent parasitized.

66 per cent of the leaf hoppers were unparasitized, 34 per cent parasitized.

The following data give more specifically the extent of parasitism found in these leaf hoppers, bringing out the percentage of sexes of the parasites and their relations to each other.

1 male leaf hopper with 2 male parasites[1] = 2 parasites.
11 male leaf hoppers with 1 male parasite = 11 parasites.

12 male leaf hoppers with 13 male parasites.

3 female leaf hoppers with 2 male parasites = 6 parasites.
13 female leaf hoppers with 1 male parasite = 13 parasites.

16 female leaf hoppers with 19 male parasites.

28 leaf hoppers with 32 male parasites.

2 male leaf hoppers with 2 female parasites = 4 parasites.
4 male leaf hoppers[2] with 1 female parasite = 4 parasites.

6 male leaf hoppers with 8 female parasites.

[1] This *Stenocranus* also contained 1 dryinid puparium.
[2] One of these also contained a dryinid puparium.

1 female leaf hopper with 3 female parasites= 3 parasites.
1 female leaf hopper with 2 female parasites= 2 parasites.
5 female leaf hoppers with 1 female parasite= 5 parasites.

7 female leaf hoppers with 10 female parasites.

13 leaf hoppers with 18 female parasites.

1 male leaf hopper with 4 male, 1 female (5) parasites=4 male, 1 female=5 parasites.

2 male leaf hoppers with 1 male, 1 female (2) parasites=2 male, 2 female=4 parasites.

3 male leaf hoppers with 6 male, 3 female=9 parasites.

2 female leaf hoppers with 2 male, 1 female (3) parasites=4 male, 2 female=6 parasites.

4 female leaf hoppers with 1 male, 1 female (2) parasites=4 male, 4 female=8 parasites.

1 female leaf hopper with 1 male, 2 female (3) parasites=1 male, 2 female=3 parasites.

7 female leaf hoppers with 9 male, 8 female=17 parasites.

These figures give a total of 48 male and 29 female parasites to 51 hosts. The proportion of parasite sexes is therefore 62.3 per cent males, 37.7 per cent females. Of the female parasites 18, or 61 per cent, occurred in hosts containing no male parasites.

Arranging the parasites according to sex of hosts we find that 39.5 per cent of the males occurred in male hosts and 60.5 per cent in female hosts, while 37.9 per cent of the females occurred in male hosts and 62.1 per cent in female hosts, or taking both sexes together, 38.9 per cent were in male hosts and 61.1 per cent in female hosts.

The location of the parasites may be summarized as follows:

5 males protruding from the third segment, dorsal; 1 male protruding from the third segment, lateral; total, 6.

11 males protruding from the fourth segment, dorsal; 4 males protruding from the fourth segment, lateral; total, 15.

19 males protruding from the fifth segment, dorsal; 3 males protruding from the fifth segment, lateral; 3 males protruding from the fifth segment, ventral; total, 25.

1 male protruding from the sixth segment, dorsal; total, 1.

3 females protruding from the first segment, lateral; 1 female protruding from the first segment, ventral; total, 4.

1 female protruding from the second segment, dorsal; 5 females protruding from the second segment, lateral; total, 6.

2 females protruding from the third segment, dorsal; 9 females protruding from the third segment, lateral; total, 11.

1 female protruding from the fourth segment, dorsal; 6 females protruding from the fourth segment, lateral; total, 7.

1 female protruding from the fifth segment, lateral; total, 1.

These figures show that the majority of the males protrude from the fifth segment, and also that they are most always dorsal, while the females are mostly found in the third and are usually lateral, and almost never ventral.

The following additions should be made to the summaries of the interrelationships of the parasites and hosts on pages 25 and 26 of Bulletin 66:

SEX OF HOSTS EXAMINED.

Polistes metricus (Wheeler, 1910), 1,000 wasps; 13.7 per cent males, 86.3 per cent females.

Polistes variatus (McAtee), 61 wasps, 100 per cent females.

Stenocranus saccharivorus (Jones), 150 leaf hoppers; 47.3 per cent males, 52.7 per cent females.

SEX OF PARASITIZED HOSTS.

Andrena nigroaenea (Theobald, 1892), 40 bees; 45 per cent males, 55 per cent females.

Andrena pratensis (Friese, 1883), 32 bees; 46.8 per cent males, 53.2 per cent females.

Andrena tibialis (Enock, 1875), 45 bees; 82.2 per cent males, 17.8 per cent females.

Polistes annularis (Nebraska records), 8 wasps, 100 per cent females.

Polistes metricus (Wheeler, 1910), 251 wasps, 9.9 females.

Polistes variatus (McAtee), 31 wasps, 100 per cent females.

Stenocranus saccharivorus (Jones), 51 leaf hoppers; 41.1 per cent males, 58.9 per cent females.

PARASITISM OF MALE HOSTS.

Polistes metricus (Wheeler, 1910), 137 males; 18.3 per cent parasitized.

Stenocranus saccharivorus (Jones), 71 males; 29.6 per cent parasitized.

PARASITISM OF FEMALE HOSTS.

Polistes metricus (Wheeler, 1910), 863 females; 26.2 per cent parasitized.

Polistes variatus (McAtee), 61 females; 52.5 per cent parasitized.

PERCENTAGE OF PARASITISM ACCORDING TO SPECIES.

Polistes metricus (Wheeler, 1910), 1,000 wasps; 25.1 per cent parasitized.

Polistes variatus (McAtee), 61 wasps; 52.5 per cent parasitized.

Stenocranus saccharivorus (Jones), 150 leaf hoppers; 34 per cent parasitized.

SEX OF PARASITES.

Polistes annularis (Nebraska), 62 parasites; 85.4 per cent males, 14.6 per cent females.

Polistes metricus (Wheeler), 562 parasites; 78.8 per cent males, 21.2 per cent females.

Polistes variatus (McAtee), 66 parasites; 33.3 per cent males, 66.7 per cent females.

Stenocranus saccharivorus (Jones), 77 parasites; 62.3 per cent males, 37.7 per cent females.

MAXIMUM PARASITISM TO THE INDIVIDUAL.

Polistes annularis (Nebraska), 1 female wasp with 11 male parasites, 1 female with 8 male parasites.

Polistes variatus (McAtee), 3 female wasps with 4 parasites each.

Stenocranus saccharivous (Jones), 1 male leaf hopper with 4 male, 1 female parasite.

To the list of exceptions in which there are more female than male parasites[1] should be added the above-mentioned record of *Polistes variatus*, which, like the other two exceptions, is a winter and spring record.

It is of especial interest that in Homoptera the female parasites are placed farther forward than in Hymenoptera, while the males are farther back. In Hymenoptera the third segment is the normal position for males and the fifth for females. In *Delphax* this is directly reversed. This is probably because the Hymenopterous parasite has the female largest, while the Homopterous parasite has the male largest.

Of special interest are the two occurrences of dryinids and strepsiptera in the same host.

4. Alteration of general features.

e. Punctuation.—According to Smith and Hamm (1914), parasitized *Andrena nigroaenea* males "tend to have the abdomen dull, very much as in the female, and this appears to be due to the deeper and more frequent punctuation on the abdomen and not to a greater hairiness. The stylopised females do not appear to be affected either in punctuation or hairiness."

f. Wing venation.—In Bulletin 66, under the paragraph 5*c*, several instances of alteration of wing venation characters in bees due to stylopization were recorded.

An excellent example of how parasitism renders this valuable character instable is illustrated on Plate 73, which shows the wings of four individuals of *Agallia uhleri* parasitized by *Agalliaphagus uhleri*. The number of apical cells in the wings varies from three to six and various unusual veins occur in unexpected places. Figure 2 on this plate is almost a normal wing. The other wings show several very remarkable features, such as the veins outside the marginal in figure 3 and the complete development of all the anal veins in figure 4. The wing in figure 2 has a total of 14 cells, that in figure 4 has 18 cells.

[1] Bulletin 66, p. 27.

5. Alteration of external sexual characters.

SECONDARY SEXUAL CHARACTERS.

a. Color of clypeus.—Smith and Hamm (1914) have added another record of the tendency of clypeus to assume the color of the opposite sex. A stylopised female *Andrena chrysosceles* Kirby was found by Mr. Hamm at Sandford, near Oxford, England, which had the clypeus colored as in the male. An illustration is presented in their plate 35 of the normal faces of each sex and of the face of this parasitized female. The authors are in error, however, when on page 453 they write: "We have already seen that no other observer has apparently described the effect of *Stylops* on the clypeus coloration of certain *Andrena*, noticed by Perez, until we came across the case of *A. chrysosceles* published here." It is hardly conceivable how they could have made such a statement when they claim to have consulted the writer's Revision of the Strepsiptera (Bulletin 66), which on page 33 cites three such instances under the same heading as above.

The same writers also mention cases of *Andrena labialis* furnished them by Messrs. Perez and Perkins, consisting of four female bees parasitized by females, which show the faces colored as in the males, and a male bee parasitized by a male *Stylops* which shows a marked reduction of the white color on the face.

A specimen of male *Panurginus californicus* from Los Angeles, California, is at hand with the yellow on the clypeus reduced to a narrow median line.

d. Antennae.—Smith and Hamm (1914) found no evidence of modification due to stylopization in the antennae of *Andrena nigroaenea.*

e. Organs of work.—Smith and Hamm (1914), in their studies of parasitized *Andrena nigroaenea*, found "that as a result of stylopisation the male does not acquire in any degree the scopa of the female, while the scopa of the female is always to some extent reduced in size by the action of stylopisation."

PRIMARY SEXUAL CHARACTERS.

a. Ovipositor.—Smith and Hamm (1914) were unable to find any modification in this organ in stylopised *Andrena nigroaenea.*

b. Male copulatory organs.—Smith and Hamm (1914) were unable to find any modification in these organs in stylopised *Andrena nigroaenea.*

7. Injury to internal organs.

a. Alimentary system.—Perkins (1892) found no effect upon the digestive tract of *Andrena nana* Kirby and *Andrena wilkella* Kirby.

e. Reproduction.—Perkins (1892) writes: "In all the male specimens that I dissected the *vesiculae seminales* were found to contain

active spermatozoa. On mounting in water their movements could be plainly seen through the walls. Their form was normal, and they behaved in the usual manner when treated with fluids.

Smith and Hamm (1914) found in 20 females *Andrena nigroaenea* the ovary very greatly reduced in size and incapable of producing mature ova. They gave illustrations to illustrate the extent of the reduction which occurred with both male and female parasites. They found no effect on the male testes or the production of spermatozoa.

The writer has already mentioned the reduction of the ovary in the *Polistes bellicosus* taken in Arizona. Only one mature egg was contained in the ovaries, these organs being crowded into a very small terminal space.

A still later record is that of the parasitized *Oncometopia undata*, recorded above, in which the reproductive organs were completely destroyed.

8. *Effects upon normal functions.*

Smith and Hamm (1914), with regard to *Andrena nigroaenea*, write:

> We also find that stylopised females never carry any pollen on their scopae, in marked distinction from the normal females, the majority of which are found with their scopae plastered with pollen, as shown in figure 18. The stylopised females have evidently lost the instinct for collecting pollen, though they still continue to visit the burrows. Of the hundred or so stylopised females examined, not a single individual had pollen on it.

This observation conforms with Perez's generalizations; but it must be remembered that the present writer has cited *Andrena crawfordi* as often carrying pollen when parasitized.

BIOLOGY OF THE PARASITE.

Fertilization.

The question of fertilization of the Strepsiptera is still a matter of controversy. Although the evidence favoring the belief that fertilization occurs is very strong, there are a number of writers who do not accept it as even a possibility.

The evidence pointing toward fertilization is based (1) upon Smith and Hamm's (1914) statement that "the male does not show any trace of degeneracy in its internal reproductive organs, vesiculae seminales being crowded with active spermatozoa;" (2) that many observers have noted the males visiting parasitized hosts containing females; (3) that males have actually been observed in copulation by Sagemehl (1882) on *Andrena parvula*, by Crawford (Pierce, 1909) on *Panurginus innuptus*, by Muir (1906) on *Perkinsiella vitiensis*, and by Crawford on *Andrena*, species (June 12, 1916) in Montgomery County, Maryland.

The arguments in favor of parthenogenesis begin with that of Perkins (1892), who believed that parthenogenesis must occur in the parasites of *Halictus tumulorum* (*Halictoxenos species*) because out of hundreds of parasitized bees he had never found a male parasite. It is quite true that the males are seldom seen, for the writer is the only one who has ever captured an *Halictus* with a male parasite. This is no valid argument for parthenogenesis, however, because it is quite possible that the presence of a male parasite renders the flight of the host more difficult, or that observations were made at the wrong time of the year.

The next claim for parthenogenesis was set forward by Brues (1903) in his studies of *Xenos wheeleri* Pierce in *Polistes metricus* Say based upon his contention that—

> Two polar bodies are produced and the female pronucleus retreats toward the center of the egg. It is closely followed by one of the polar bodies, presumably the second; the chromatin in its nucleus assumes the reticulate form, as does also that of the second polar body, which has a much smaller nucleus and protoplasmic body than the female pronucleus. When both have nearly reached the center of the egg they place themselves side by side and finally fuse, giving rise to the cleavage nucleus.

And also because—

> There is no arrangement for the spermatozoa to reach the eggs without passing through the epithelium closing the internal ends of the oviducts and traversing a considerable part of the fat body.

Smith and Hamm (1914) consider Brues's evidence incomplete because he did not follow polar body formation, but they advance five reasons why they think parthenogenesis does occur. Their first and second reason coincide with the second referred above to Brues:

> (1) There is no opening or apparatus in the female adapted for conveying the spermatozoa to the eggs; (2) the eggs remain throughout their development incased in the follicular epithelium of the ovary, so that access to them by spermatozoa which had entered the body cavity is very difficult to imagine.

The third reason is based upon Perkins's assertion concerning *Halictus*. The fourth reason is that:

> The known stages in the polar body formation of *Stylops* are inconsistent with the view that fertilization by a spermatozoon has been effected.

Elsewhere they make a statement which does not agree with that of Brues quoted above.

> In several females the eggs have been found in an early stage of development the features of which strongly confirm our suspicion that development is parthenogenetic. In these cases all the developing eggs are at approximately the same stage of development, exhibiting two or, in some cases, more segmentation nuclei, while at the periphery of the egg a mitotic spindle is observed, which invariably exhibits a single large chromosome and three or four smaller ones often in process of division. Each egg is completely invested by the follicular epithelium.

Now, it is quite clear that the mitotic spindle must represent the first polar body in process of division. There is, however, no trace of a second polar body, which there certainly ought to be if a second polar body was given off and fertilization effected in the usual way.

Since Brues differs with Smith and Hamm concerning the numbers of polar bodies we may safely claim that in neither case has parthenogenesis been proved.

The fifth reason is that—

Actual copulation by the male has never been adequately observed.

Since Smith and Hamm claim to have consulted Bulletin 66, although they incorrectly refer to it, they evidently are indisposed to accept the three definite records of copulation having been observed, as recorded therein. It is difficult to conceive how one can more adequately observe the act of copulation.

As a supplemental reason they state that—

In a large number of colonies of infected *Andrena* it would appear that the male parasite is very much scarcer than the female, and in certain cases may have almost entirely died out.

It is of interest therefore to note the many records which have been tabulated by the writer on the sex of parasites. Up to the present time the tabulation of all counts of sex by various observers gives 1,318 males to 634 females. Of course no account has been made of the many miscellaneous single observations of stylopisation listed in the host lists of the order.

The evidence for parthenogenesis therefore consists of an inability to explain how the spermatozoa, which are conceded to exist, can reach the eggs, and of contradictory interpretations of the polar body and maturation phenomena observed in a limited number of cases. The burden of the proof lies with the advocates of parthenogenesis.

It is of course possible that parthenogenesis may occur in some cases, but its existence is still a matter of doubt.

Oogenesis.

Hoffman (1913) presents a very complete embryological study of a parasite from an undetermined host from Paraguay beginning with the blastoderm and carrying it to the triungulinid. This parasite was later (Hoffman, 1914b) described as *Xenos bohlsi.* He finds eggs in all states of development in the same parent and not all developing uniformly as found by Brues (1903). He shows the nervous system in the early embryos to consist of a cerebral ganglion and a ventral ganglion reaching to the eighth abdominal segment, but this gradually shortens until it lies in the third or fourth ab-

dominal segment. Six sectional drawings of various stages of the embryo are presented.

The writer has many slides containing triungulinids of various species in various stages of embryonic development as well as ready to emerge, all taken from single parents.

Metamorphosis.

A speciment of *Pseudoxenos* from a female *Rhygchium* collected by F. Muir in Amboina was extracted as a perfect male in its puparium, having shed its pupal skin. The larval skins were in a compact mass at the apex of the puparium. This is the first time they have been found. The material was received preserved in alcohol, which accounts for its perfect condition.

Alimentation.

With regard to the nourishment of *Stylops melittae*, Smith and Hamm (1914) remark that:

> The skin, except where the epithelium of the brood passage is especially modified, is exceedingly thin, and the nourishment of the body must take place by absorption through this skin. There are no special cells for seizing on or elaborating a special kind of food either in the skin or elsewhere, so that we may suppose that the haemolymph of the bee affords a ready-made medium which supplies the parasite with all that is requisite.

Attraction of males to light.

In Bulletin 66 mention was made of the collection of an *Elenchus* at light in Ceylon. This was the first record of such a capture. In the supplement to the monograph (Pierce, 1911) the writer added to this species *Triozocera texana*, taken at light in Texas, and *Myrmecolax nietneri*, taken at light in Ceylon. Four more such records have now appeared in print, and another is added in this paper. The eight species thus recorded belong one in Mengeidae, one in Mengenillidae, one in Myrmecolacidae, one in Stylopidae, three in Halictophagidae, and one in Elenchidae.

AUSTROSTYLOPS GRACILIPES Lea.

Several males were collected in the greasy oil of a lamp at Bridgetown, West Australia, in 1895 (Lea, 1910).

PARASTYLOPS FLAGELLATUS Meijere.

Males were collected at lights at Semarang, Java, in January, February, October, and September (Meijere, 1911).

TETTIGOXENOS CLADOCERAS Jeannel.

The type male of this species was taken at a light at Station No. 8, south of Mombasa, at the river Ramisi, in British East Africa, in November, 1911. The type locality is illustrated (Jeannel, 1913).

NEOCHOLAX JACOBSONI Meijere.

A male of this species was collected at night in Java (Terry, 1912). The host of this species is *Ossoides lineatus* Bierman a Tropiduchid (Meijere, 1911).

CYRTOCARAXENOS JAVANENSIS Pierce.

A male was collected at light, August, 1908, at Buitenzorg, West Java, by F. W. Terry.

BIOLOGICAL NOTES.

STYLOPS MELITTAE Kirby.

Smith and Hamm (1914) write that:

At the end of April and beginning of May, 1912, the male *Stylops* was not uncommon in the vicinity of the colony of *Andrena nigroænea*, being seen on the wing at midday in sunshiny weather.

This observation was made near Oxford, England:

None were observed actually flying over the burrows of the bee and nearly all then first seen were some 10 or 15 feet from the ground.

When placed in boxes with bees containing females:

The male *Stylops*, directly it was introduced into the box, fluttered on to the bee and quickly ran over its body to where the head of the female *Stylops* was everted between the bee's abdominal segments. At this time the male is rapidly vibrating its wings and protruding its last two or three apical segments, which are long and tapering like an ovipositor.

Actual pairing did not occur on any of the three occasions.

After about 10 or 15 minutes of ceaseless running to and fro over the bee, the male *Stylops* voluntarily quitted the *Andrena*, but still continued to run and vibrate its wings for about two hours longer, after which time it dropped apparently exhausted and died shortly afterwards.

DACYRTOCARA UNDATA Pierce.

Two females extracted from a female *Oncometopia undata* Fabricius collected in May, 1915, at Thomasville, Georgia, had the body filled with eggs in an early stage of development. These females were each 7 mm. long.

MORPHOLOGY AND ANATOMY.

INTERNAL STRUCTURE.

An important article on the metamorphosis of some of the anatomical structures of *Xenos rossii*, taken at Freiburg in *Polistes gallica*, has been contributed by Paul Rösch (1913). This work is in reality supplementary to Nassonow's excellent treatises. The principle features of this discussion are the development of the eyes,

the development of the cephalic ganglion, and the metamorphosis of the mesoderm.

Alimentary system.—Smith and Hamm describe the alimentary canal of a female *Stylops melittae* Kirby in *Andrena nigroaenea* as follows:

> There is a minute mouth opening, and an equally minute anus at the hind extremity, but the lumen of the gut through the body is obliterated. The whole apparatus is obviously functionless.

This description is supplemented by drawings of longitudinal and cross sections.[1]

Vascular system.—Smith and Hamm state that in *Stylops melittae* the remains of the dorsal blood vessel or heart can be recognized dorsally to the gut.[2]

The aorta is shown very indistinctly by Nassonow in *Stylops melittae* Nassonow (not Kirby).[3]

Nervous system.—To the rather limited knowledge of the nervous system in this order Smith and Hamm have added a brief description and a drawing of a section of the nervous system of *Stylops melittae* Kirby. They found only the normal three ganglionic masses, the brain, the thoracic and ventral ganglia.[4]

Tracheal system.—Although Smith and Hamm refer to Nassonow's valuable works on the anatomy of the Strepsiptera they do not seem to have used them in their own work on anatomy of *Stylops melittae.* Consequently, in their description of the tracheal system, they overlook the existence of dorsal and ventral tracheae in the abdomen as described by Nassonow both for *Stylops* and *Xenos.* They describe only a single main branch which to judge from their figure is probably the dorsal branch.[5]

Considerable mention is made in the present article of the spiracles in the discussion of the comparative morphology of the male and in the descriptions of species.

Reproductive system.—Smith and Hamm working on *Stylops melittae* have studied the brood canal and its trumpetlike invaginations and presented a number of illustrations. These illustrations are of value in that they fully corroborate Nassonow's splendid work. The writers suggest that the spiny processes of the epithelium of the brood canal are so modified as to assist the triungulinids in reaching the exterior.[6]

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[1] Smith and Hamm, 1914, p. 39, pl. 32, figs. 3 and 4, *g*.
[2] Idem, p. 439, pl. 32, figs. 3 and 4.
[3] Nassonow, 1893, *a*, pl. 2, fig. 1, *n*.
[4] Smith and Hamm, 1914, p. 439, pl. 32, fig. 3.
[5] Idem, p. 439, pl. 32, fig. 4.
[6] Idem, pp. 437, 438, pl. 32, figs. 3, 4; pl. 33, figs. 6, 7.

EXTERNAL STRUCTURE.

TRIUNGULINID.

The triungulinid or first larva (fig. 1) of the Strepsiptera resembles most in form the larvae of the Dipterous family Cyrtidae, of which the first stage of *Pterodontia flavipes* Gray has been described. This larva, of course, differs from the Strepsiptera by being legless and without mandibles. The first larvae of the Meloidae and Rhipiphoridae are very different in appearance. Those of Meloidae have the tarsus consisting of three claws (figs. 2, 3), while the Rhipiphoridae have a single claw at the base of a pulvillus (fig. 4).

The Strepsipterous hexapod larva is a well-organized larva with head, 3 thoracic segments, and 10 abdominal segments. The eyes

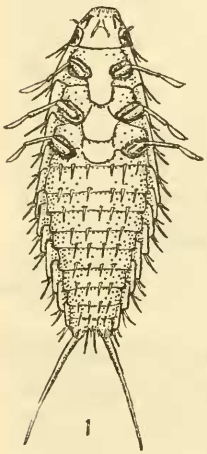

FIG. 1.—STYLOPS SWENKI. VENTRAL VIEW OF TRIUNGULINID SIZE 0.158 MM.

FIG. 2.—MELOID TRIUNGULIN. VENTRAL VIEW.

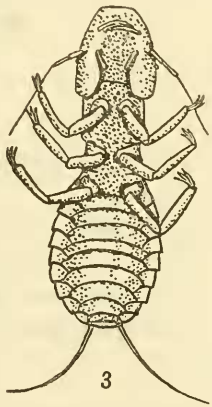

FIG. 3.—MELOID TRIUNGULIN. VENTRAL VIEW.

consist of rather large ocelli in a group. The largest ocellar lens in proportion to the size of the head is found in the hexapod larva of *Stichotrema dallatorreanum* (pl. 67, fig. 3). It has two pair of smaller ocelli. Large spots of pigment can be seen under the lenses. The antennae of *Stichotrema* are three-jointed, with an arista on the side of the second (pl. 67, fig. 5). The mouth parts consist externally of a pair of mandibles, which in Stichotrema are very large and extend backward. There is a chitinization resembling that of Dipterous larvae surrounding the pharynx (pl. 67, figs. 2–5). The legs consist of coxa, femur, tibiae, and one-jointed clawless tarsus. The episternal sclerites are quite distinct in Stichotrema (pl. 67, fig. 3). The first seven abdominal segments are normal in all species. The eighth, ninth, and tenth are variously modified. The tenth bears a pair of very long stylets (pl. 67, figs. 1, 2).

The larva of *Callipharixenos muiri* has five pair of ocelli, with each one clearly outlined as a separate eye. The tarsi are one-jointed with three terminal filaments or claws (pl. 68, figs. 4–7).

The larva of *Stylops swenki* is illustrated in text figure 1 and of *Stylops californica* on plate 71.

It is presumed that the first elongate joint of the leg is the femur, although it may be the trochanter. In the latter case tarsus would be

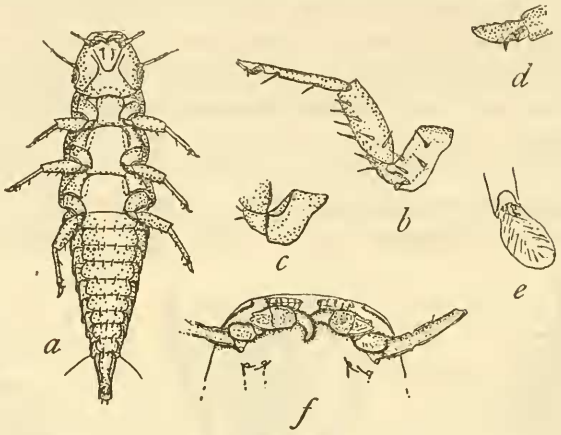

FIG. 4.—MYODITES SOLIDAGINIS PIERCE. *a*, TRIUNGULINID, VENTRAL VIEW; *b*, POSTERIOR LEG; *c*, POSTERIOR COXA; *d*, PULVILLUS, LATERAL VIEW; *e*, PULVILLUS, VENTRAL VIEW; *f*, MOUTH PARTS, VENTRAL VIEW.

absent in Stichotrema (pl. 67), *Stylops* (pl. 71, fig. 7), etc., and the writer is not willing to accept this view.

Aberrations.—Hoffman (1914*b*) describes aberrant triungulinids of *Xenos bohlsi* Hoffman and *Eupathocera sphecidarum* Dufour.

FEMALE.

The female structure is not subject to as many modifications as that of the male. In fact, so few are the characters that the writer had been obliged to use comparative measurements of the dimensions of the cephalothorax to separate species. Figure 5 represents a generalized female cephalothorax and shows the location of the measurements which are used throughout the present paper. Measurement No. 1 is the width at the spiracles (posterior pair when two occur); No. 2 is the width of the base of the head; No. 3 is the width of the head at the emargination near the base of the mandibles; No. 4 is the width of the cephalothorax at the base; No. 5 is the length from the front edge of the spiracle to apex of head; No. 6 is the length from base to apex of cephalothorax.

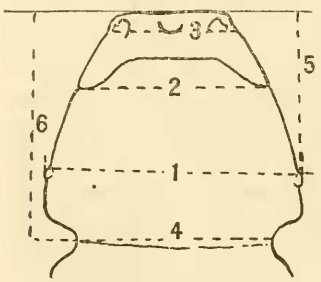

FIG. 5.—DIAGRAM ILLUSTRATING MEASUREMENTS USED IN DESCRIBING FEMALE CEPHALOTHORAX.

The mandibles show some fair characters in the genus *Stylops* and are used in the tables. The principal variation is in the number and position of the teeth. (See pl. 71.)

The spiracles furnish good characters as to number, position, and form. The Callipharixenidae have two pair of spiracles on the cephalothorax (pl. 68, figs. 1, 2). The Xenoidea have otherwise only one pair, and it is presumable therefore that this family are not Xenoid but rather Mengeoid. Abdominal spiracles have not been noticed except on *Dacyrtocara undata*, which has three pair. (pl. 74, figs. 5, 6.)

The median unpaired genital tubes are so often impossible to find because of the condition of the material that it is the writer's practice to note them whenever observed. In addition to the records already published it may be noted that *Callipharixenos muiri*, *Chrysocorixenos siamensis*, and *Stylops vicinae* have five tubes, and *Dacyrtocara undata* has two (pl. 74, figs. 5, 6).

In the Dacyrtocara the first abdominal segment extends far in front of the cephalothorax, but within the host's abdomen (pl. 74, figs. 5, 6).

The female type of *Chrysocorixenos siamensis* has an asymmetrical cephalothorax, there being a sort of tumor near the base of one side.

MALE.

The writer has from the beginning of his work on this order attempted to find other characters beside those of the appendages for use in classification. Although it was quite apparent that the legs, antennae, mouth parts, and genitalia gave a satisfactory and logical system of classification, there was always the possibility of not being able to identify the insect if the appendages were lost.

The dorsal thoracic characters were delineated in the specific descriptions in Bulletin 66, and transferred to the generic descriptions in Genera Insectorum. But the great divergence of thoracic structure did not seem to permit their use in family descriptions or phylogenetic studies.

Since the last contribution on the order many new species have been received and a study of these with a review of material already described now makes it possible to give a clearer treatment of the comparative morphology of the group.

Progression of characters.—Certain striking trends of modification are apparent. The antennae may be considered to have had typically seven joints with at least the third laterally produced, flabellate. These appendages are found in the order with any number of joints from four to seven, and with from one to five joints flabellately produced.

The tarsi are typically five-jointed with two terminal claws (pl. 64, figs. 1, 10; pl. 65, fig. 1). In the progression of characters we find four-jointed (pl. 69, fig. 1), three-jointed (pl. 75, figs. 1, 7), and two-jointed tarsi without claws.

The wings have typically eight primary veins—costa, subcosta, radius, medius, cubitus, and three anal. One or more of these is frequently absent, although the first four are always present.

The prothorax has a tendency to crowd forward into the head.

The metathoracic praescutum rises from a depressed necklike position (pl. 66, figs. 1, 5, 6) to a part of the disk (pl. 64, figs. 1, 10) and tends to crowd backward (pl. 69, fig. 1), separating the scutum into two lateral pieces and pushing the scutellum far back (pl. 76, fig. 1). The scutum, in addition to dividing on each side of scutellum (pl. 64, fig. 10), also tends to divide transversely from the base of the wing to the scutellum to form the parascutellum (pl. 65, fig. 8). The postlumbium, although normally intersegmental (pl. 69, fig. 2), has at least in one case become a chitinous part. The pleural suture frequently fails to reach the coxae (pl. 65, fig. 7). The scutellum proper never reaches the base of the wings, but a small, absolutely detached part is connected by a long axillary cord to the wing (pl. 65, figs. 6, 7; pl. 66, fig. 7; pl. 70, fig. 4; pl. 72, fig. 1).

Normally the abdomen has the ninth or genital segment ventrally greatly surpassing the tenth or anal segment, and all the other segments normal ringlike.

In the Halictophagoidea the eighth segment ventrally also is often greatly produced (pl. 75, fig. 4; pl. 78, fig. 3).

COMPARATIVE MORPHOLOGY.

Eyes.—The head is characterized by the large raspberrylike eyes with separated ommatidia. These vary slightly in shape, but are usually spherical and very hairy on the partitions. The number of ommatidia is quite variable (see the various plates).

Mouth parts.—The mouth parts are extremely simple, being merely a pair of mandibles and a pair of maxillae placed distant from the exposed pharyngeal opening. Labrum and labium are absent in the adult, although present in the last larva. The mandibles in the earlier groups are all elongate, falciform, glabrous, and chitinous (pl. 66, figs. 4, 7). In the Halictophagoidea they are often mere fleshy pubescent appendages. The mandible of *Triozocera mexicana* is the most minute yet seen, being reduced to the size of a seta (pl. 65, fig. 4). The maxillae are fleshy, pubescent appendages usually with a one-jointed palpus (pl. 74, fig. 2), but in *Crawfordia* with a two-jointed palpus. The palpus is usually terminal, but in *Triozocera mexicana* (pl. 65, fig. 5) and several species of *Xenos* it is lateral. In *Liburnelenchus koebelei* a chitinous filament is attached to the basal joint of the maxilla.

Vertex.—The head is emarginate behind in Mengeoidea, but the emargination is merely taken up by intersegmental skin (pls. 64, 65, 66). In the Halictophagoidea it is also frequently emarginate, with the thorax crowded into the emargination (pls. 74, 75, 76, 78).

Antennae.—The antennae are very remarkable in all genera of the order. They furnish an excellent basis for family characterization.

The Mengeidae have seven jointed antennae, with the third and fourth joints laterally produced, flabellate (pls. 64, 65).

The Mengenillidae have six jointed antennae with the last four joints laterally produced, flabellate (pl. 66).

The Myrmecolacidae have seven jointed antennae with the third joint laterally produced, the fourth minute, and the following joints greatly elongated (pl. 69).

The Stylopidae have six jointed antennae with the third joint only laterally produced (pl. 70).

In the Hylecthridae the antennae are five-jointed, with the third oint laterally produced, the fourth minute, and the fifth flabellate.

The Xenidae (pl. 72) and Diozoceridae (pl. 78), have four jointed antennae, with the third joint laterally produced and the fourth flabellate subequal to the produced part of the third.

The Halictophagidae have seven jointed antennae, with the last five joints laterally produced and flabellate (pls. 74–78).

The Elenchidae have five jointed antennae, with only the third joint laterally produced, but the fourth and fifth are elongate and similar to the prolongation of the third.

The surface of the antennae is extremely sensitive, being covered with little cylindrical disks which are protected by multitudes of setigerous tubercles.

Prothorax.—The prothorax throughout the order is small and reduced. Normally it is ringlike, with no differentiated parts dorsally or laterally. In *Triozocera texana* (Mengeidae) (pl. 64, fig. 2), the most generalized species available for study, the sternum has a tiny triangular area in front (presternum), a narrow transverse eusternum, a subquadrate central area (the sternellum) which is divided longitudinally and transversely by heavily marked chitinizations. a tiny poststernellum and a transverse spinasternite. The pleural area is not visibly separated from the notum or the eusternum, but posteriorly forms a hook, opposite the transverse chitinization of sternellum. These two points form the bases of attachment of coxa.

In Tetrozocera (Mengenillidae) the sternum consists solely of a spindlelike piece longitudinally divided, and which is probably composed of sternellum, precoxale, and trochantin at least, because the coxa is attached to a point at the extreme lateral tip; and a small triangular poststernellum in the middle (pl. 66, fig. 2).

Dacyrtocara oncometopiae (Halictophagidae) has the same type of prosternum but lacks the tiny poststernellum. The pronotum is pushed far forward in the head, and the pleurites are narrow strips almost invisible from above, being inclosed in the head (pl. 74, fig. 2).

Xenos hubbardi (Xenidae) has the pronotum simple, but the sternum is transversely divided into a narrow eusternum and a slightly broader band, which is longitudinally divided and has a posterior projection about the middle of each piece to which the coxa is attached. This piece is therefore the sternellum+precoxale+trochantin+episternum+epimeron.

Pyrilloxenos compactus (Halictophagidae) furnishes the best opportunity for understanding the prosternal and mesosternal areas. The eusternum is a narrow transverse piece. The sternellum is longitudinally divided. Each side forms a half ring, composed also probably of precoxale and trochantin, between the points of which the coxa is attached. This is the only prosternum in which a distinct pleural suture has been noticed. The episternum reaches the coxal attachment in front of the suture and behind it the epimeron is divided, reaching the coxa as hypoepimeron. The epimeron is slightly visible above. Episternum is not visibly separated from the epinotum (pl. 77, fig. 2).

Anthericomma barberi (Halictophagidae) has a very interesting prothorax. The pronotum is a circular disk completely inclosed by the head and mesonotum. The pleural region is completely within the mesopleurum. The sternum consists merely of two oval pieces longitudinally separated, to which the coxae are attached, and at each side of which appear parts of mesosternum. These two pieces are the combined parts of sternellum, precoxale, and trochantin.

In *Delphacixenos anomalocerus* (Halictophagidae) the pronotum is even smaller than in the preceding species, and the prosternum is similarly reduced.

In summary therefore we may describe the prothorax as a very highly modified segment with the parts crowded and often fused.

The prolegs are composed of a tiny coxa at the base of an elongate trochanter, femur, tibia, and tarsus. In previous works the coxa was overlooked. Practically all the important variation is in the tarsus, which is five-jointed with two claws in the Mengeoidea (pl. 64–66), four-jointed without claws in the Xenoidea (pls. 69, 70, 72), three-jointed in the Halictophagoidea (pls. 73–78), and two-jointed in the Elenchoidea. In the Mengeoidea the first three joints are cylindrical, the fourth flattened with pulvillus, the fifth elongate with pulvillus. In the Halictophagoidea the first joint is often very broadly flattened, pulvillate, and the succeeding joints are narrower, the last elongate (pl. 74, fig. 1). The femur and tibia are greatly shortened and broadened in *Pentozoe peradeniya* and *Dacyrtocara oncometopiae* (pl. 74, fig. 2).

Mesothorax.—The mesothorax throughout the order is small and reduced, but not so much as the prothorax. Normally it is ring-like. The mesonotum of *Triozocera texana* (Mengeidae) is transversely faintly divided into two parts, the front probably best considered as the scutum and the posterior part the scutellum. The elytra or balancers are club-shaped and attached near the front of the pleural zone. They have a tiny hook at base, which probably assists in the noise making produced when the elytra are in vibration. The pleural zone immediately beneath the attachment of the elytra is broadly lobately produced and has the anterior edges rough. This may serve as a sort of drum. The lobe is the episternum+epimeron, and probably includes the trochantin in its posterior hook to which the coxa is attached. The sternellum is quadrate and longitudinally divided; the eusternum is a transverse band laterally enlarged and partially merging in the episternal lobe. It is depressed in the enlarged portion and bears a long stigmatal opening (pl. 64, figs. 2, 5).

There is a distinct anal lobe on the elytron of *Xenos auriferi*, *Stylops championi*, and *Neostylops Shannoni*. It has not been noticed on other species (pl. 70, fig. 6).

Tetrozocera santchii (Mengenillidae) has a simple band-like mesonotum, but the mesosternum has three transverse areas, the presternum, eusternum, and sternellum. The latter is longitudinally divided, each half being triangular with the coxae attached at the lateral angles. The epimeron is only visible from the side (pl. 66, fig. 2).

In *Muirixenos dicranotropidis* (Halictophagidae) the mesonotum consists of three transverse distinct areas—the praescutum, scutum and scutellum, and postscutellum (pl. 76, fig. 1). These areas are also distinct but differently formed in *Pentozoe peradeniya*, and *Dacyrtocara oncometopiae* (pl. 74, fig. 1).

In *Delphacixenos anomalocerus* only two transverse dorsal areas are distinguishable, the front piece being praescutum. This condition is also found in *Pyrilloxenos compactus*.

Dacyrtocara oncometopiae has the eusternum large, triangular, extending between the hooks of the sternellum. The episternum is large, lobed beneath the base of elytra, and posteriorly forms with trochantin the hook to which the coxa is attached (pl. 74, fig. 2).

Pyrilloxenos compactus has the most parts to its mesosternum of any species examined. The eusternum is large, triangular, as in the preceding, and separates the two hooks of sternellum. The half ring, at the ends of which coxa is attached, consists of three distinct parts, sternellum, precoxale, and trochantin. The pleural suture separates episternum and epimeron to the tips of the hooks formed with trochantin (pl. 77, fig. 3).

The middle legs are like the anterior legs except that in the Halictophagidae the first tarsal joint is usually mucronate. The

coxae and tronchanter are apparently often fused. The coxa is never more than a tiny basal piece of trochanter.

Metathorax.—The metathorax is the dominant part of the body of the male strepsipteron and is the part most characteristic of the order as a whole. It differs most from other orders in the prominence of the postlumbium throughout the order, and the unusual development of the postscutellum. The pleural suture is almost horizontal and longitudinal instead of vertical, as is usually found in other orders. The posterior attachment of the wings is very distant from the lateral prolongation of the scutellum and if attached at all the axillary cord is very long.

In view of the fact that the metathorax has been illustrated for each genus and fully described in the generic descriptions, this discussion will take up the various parts separately and trace their modifications.

Praescutum.—The anterior visible piece of the metanotum is the praescutum. It is as broad as the scutum, and band-like as the pronotum and mesonotum in *Mengea* (Mengeidae) (pl. 64, fig. 1), large and broad and not fully separated from the scutum in *Triozocera* (Mengeidae) (pl. 64, fig. 10; pl. 65, fig. 1); suppressed as a neck in *Tetrozocera* and *Austrostylops* (Mengenillidae) (pl. 66, figs. 1, 5); raised to the disk but narrower than scutum in *Mengenilla* (Mengenillidae) (pl. 66, fig. 6). In these two families which form the Mengeoidea the praescutum lies entirely in front of scutum and scutellum and does not in any way push backward.

In the remaining superfamilies the praescutum lies between the lobes of the scutum and its anterior line is more or less continuous with the anterior line of the scuti. In *Myrmecolax* the scuti somewhat constrict the praescutum before its posterior apex, but in *Caenocholax*, also of the Myrmecolacidae, this piece is semioval (pl. 69, fig. 1). In both genera of Myrmecolacidae it is longer than broad.

In Xenidae the praescutum varies but little, being either semilunar or keystone-shaped and broader than long (pl. 72, fig. 2).

In Diozocera (Diozoceridae) it is oblong, and in all Halictophagidae it is longer than broad, varying more or less in shape from oblong in Anthericomma and semielliptical in Pentozoe to pyriform in Pentozocera.

In Elenchidae it is elongate, very greatly narrowed behind (Deinelenchus) and sometimes constricted (Liburnelenchus).

Scutum.—This part is the next transverse dorsal sclerite behind the praescutum, but in most Strepsipterous genera would not be recognized as transverse. It is always strongly lobed. Normally the two lobes are connected behind the praescutum and in front of the scutellum, but this connection is only to be found in a few genera:

In *Triozocera* (Mengeidae) the scutum is narrowly connected with the praescutum on each side of the anterior apex of scutellum. It is greatly produced posteriorly (pl. 64, fig. 10; pl. 65, fig. 1). In *Mengea* it is very narrowly united in front of the broader scutellum (pl. 64, fig. 1). The lobes are posterior. The same condition exists in *Tetrozocera* (Mengenillidae) (pl. 66, fig. 1).

On the other hand, the pushing of the praescutum into the scutum in the Xenoidea and subsequent families has made the scutum humerally lobate. The bridge between the lobes occurs also in *Caenocholax* (Myrmecolacidae) (pl. 69, fig. 1), *Neostylops* (Stylopidae) (pl. 70, fig. 1), *Cyrtocaraxenos* (Halictophagidae) (pl. 78, fig. 1), and *Deinelenchus* (Elenchidae).

In all other genera studied the scutum occurs as two lateral humeral lobes separated by praescutum and scutellum (see pls. 66, 72, 75, 76, 77).

Parascutellum.—The scutum in the more generalized genera was bounded by praescutum, scutellum, and epimeron, but early in the modification of the group a suture appears, beginning at the anterior base of the wing and extending diagonally toward some part of the scutellum. This does not occur at all in *Tetrozocera* (Mengenillidae) (pl. 66, fig. 7), and is incomplete in *Triozocera* (Mengeidae) (pl. 65, fig. 8), *Neostylops* (Stylopidae) (pl. 70, fig. 4), *Myrmecolax* (Myrmecolacidae), *Halictoxenos*, and *Crawfordia* (Xenidae), *Diozocera* (Diozoceridae), and *Deinelenchus* (Elenchidae). It is complete in *Caenocholax* (Myrmecolacidae) (pl. 69, fig. 2), *Xenos* (pl. 72, fig. 1) *Pseudoxenos*, and *Tachytixenos* (Xenidae), all Halictophagidae (pl. 75, fig. 2; pl. 76, fig. 5; pl. 78, fig. 3), and *Liburnelenchus* (Elenchidae). The part behind the suture is called parascutellum because it is beside the scutellum.

Scutellum.—The third median sclerite of the metanotum is the scutellum, which is invariably broadest at its base, and anteriorly is more or less rounded or constricted. In the Megeoidea it reaches forward almost as far as the scutum and is subtriangular, but rounded at apex in *Triozocera* and more broadly rounded in *Mengea*. In these two genera it does not separate the scutal lobes completely.

In *Austrostylops* (Mengenillidae) the scutellum is very long and broadly separates the scuti in front. In *Tetrozocera* it is similar to that of *Mengea*. In *Mengenilla* it is shaped as in *Triozocera* and narrowly separates the scuti (pl. 66, fig. 6).

In *Myrmecolax* and *Caenocholax* (pl. 69, fig. 1) (Myrmecolacidae) the scutellum is short and broadly rounded. In *Neostylops* it is longer and broadly rounded (pl. 70, fig. 1).

Throughout the Xenidae scutellum is longer than praescutum (pl. 72, fig. 2). In *Crawfordia* it is anteriorly very broad, a little

less so in *Halictoxenos* and truncate at apex, and in the true *Xenini* it is constricted, pedunculate at apex.

Diozocera (Diozoceridae) has a short broadly rounded scutellum. In all the Halictophagoidea and Elenchoidea the scutellum is short and transverse, but variously curved or truncate on its anterior margin (pls. 74–78).

In other orders of insects the scutellum laterally reaches the posterior attachment of the wing, being connected therewith by the axillary cord. In the Strepsiptera the base of the scutellum is very far behind the posterior attachment of the wings, but in several genera (*Triozocera*, *Neostylops*, *Xenos*) there is a cord from the base of the wing running back and attached to a tiny sclerite on the epimeral area (pl. 65, fig. 6; pl. 66, fig. 7; pl. 70, fig. 4; pl. 72, fig. 1). In *Xenos vesparum* there is a small piece detached from scutellum but next to it and between the parascutellum and postscutellum, and beyond this is the little piece to which the cord is attached. This would indicate that two little pieces of scutellum have separated off and in later genera disappeared completely (pl. 72, fig. 1).

Postlumbium.—This flexible area behind the base of scutellum is always present and always transverse. It lies in an emargination of the base of the postscutellum, practically at the transverse axis of the body. It is usually soft intersegmental skin, but in *Eupathocera* is chitinized and of the same texture as the remainder of the notum. (See all plates with illustrations of males.)

Postscutellum.—The fifth median zone of the metanotum (counting scutellum as the second) is the postscutellum, which is the largest single piece on the entire body. It extends back far over the abdomen and is concave, allowing considerable flexibility to the abdomen, which can, to a large measure, be retracted into it in some genera. (See all plates with illustrations of males.)

Pretergite and prealare.—Pretergite occurs in front of the praescutum, but so far has only been seen in *Delphacixenos anomalocerus* (Halictophagidae). The prealare is recognizable besides the scutum or praescutum and in front of the base of the wing (pl. 75, fig. 2).

Wing sclerites.—A number of tiny pieces occur around the attachment of the wing, but have not been carefully studied (pl. 64, fig. 2; pl. 75, fig. 2).

Pleurotergite.—Between the postscutellum and epimeron or hypoepimeron is an elongate area known as the pleurotergite, and probably derived from the postscutellum. In *Tetrozocera* and other genera this is apparently divided into two pieces (pl. 66, fig. 3).

Wing.—The wings are attached far front on the metathorax, being surrounded at their base by prealare, tegula, scutum, parascutellum, epimeron, and episternum, with certain tiny pieces difficult to under-

stand. The scutellum is only connected distinctly by the cord to the tiny area far behind on epimeron opposite the base of the scutellum.

The wing venation typically consists of eight radial veins, costa, subcosta, radius, medius, cubitus, and three anal. The costa is but a short humeral thickening, beside the subcosta, which arises from it and braces the anterior margin to the middle of the wing. In *Triozocera* (pl. 64, fig. 2) the radius and medius do not have basal connections, but appear to arise from subcosta. Cubitus is isolated. The first and second anal arise from a strong basal area, and the third anal is represented by a darkened area only. In this genus a detached piece of radius strengthens the border beyond the apex of subcosta. Medius has beyond the middle two detached branches, one in front and one behind.

In *Pyrilloxenos* the number of veins is as above with the exception of the second medial branch and the third anal, both of which are lacking. Here radius branches from medius, and these with cubitus have a common source (pl. 77, fig. 7).

The cubital and anal veins are less stable than the others, and in the Elenchidae only one of them persists. The number of detached branches of radius and medius is also variable and has been discussed in previous contributions of the writer.

Pleural suture.—This suture between the episternum and epimeron is diagonally longitudinal from the base of the wing to the coxa, as in *Diozocera insularum* (Diozoceridae) (pl. 78, fig. 7), and *Tetrozocera santchii* (Mengenillidae) (pl. 66, fig. 3). It is often terminated on the sternum opposite the junction of eusternum and sternellum, as in *Xenos* (pl. 72, fig. 1).

Epimeron.—The epimeron is usually a very narrow elongate piece, reaching the base of the wing in a point and extending back above the pleural suture and beyond it to the coxa. It is sometimes separated into several parts. In *Tetrozocera* it is one continuous unbroken area from wing to coxa and hardly varies in width (pl. 66, fig. 3). In *Triozocera* it is interrupted by the small detached scutellar piece to which the axillary cord is attached (pl. 65, fig. 6). A similar piece of scutellum with attachment to the axillary cord occurs on the epimeral area of *Neostylops crawfordi* and *Xenos vesparum*. We may consider the part of epimeron in front of this little piece the epimeron pteropleurite and the posterior part which reaches the base of the coxae as hypoepimeron (pl. 65, fig. 6; pl. 66, fig. 7; pl. 70, fig. 4; pl. 72, fig. 1).

In many species epimeron also shows relationship to the sternellum (furcasternite of Crampton). This is in case the pleural suture does not reach the coxa, as in *Triozocera* (pl. 65, fig. 7), *Xenos* (pl. 72, fig. 1), and *Delphacixenos* (pl. 75, fig. 2), in which case epimeron and sternellum are fused.

Episternum.—The episternum is a well-defined, always closed area, beginning at the base of the wing, usually longitudinally elongate, and always inferior to the pleural suture. It is sometimes bilobed with a large lobe extending forward to the front of the sternum and with the alar lobe smaller and acute, as in *Triozocera mexicana* (pl. 65, fig. 7). The episternum is much broader in *Delphacixenos anomalocerus*, but is bilobed. The episternum proper is the lobe to the wing; the inferior lobe is the lateropleurite. The episternum never reaches the coxal area in the strepsipterous metathorax and in this it greatly differs from most orders of insects (pl. 64, fig. 2; pl. 65, fig. 7; pl. 66, figs. 3, 7; pl. 69, fig. 2; pl. 70, figs. 2, 4; pl. 72, fig. 1; pl. 75, fig. 2; pl. 76, fig. 5; pl. 78, figs. 3, 7).

Sternum.—The Strepsipterous sternum is a large area without distinct sutures but always having a strong median longitudinal chitinization behind. This chitinization divides the sternellum into two parts. The sternellum (furcasternite) is transversely separated from eusternum (basisternite) in front of it, mereby by a faint line, which is sometimes distinct at the sides, where it branches from the pleural suture. The anterior area or presternum is also indistinctly separated by a faint line (pl. 64, fig. 2; pl. 65, fig. 7; pl. 66, fig. 2; pl. 69, fig. 3; pl. 74, fig. 2; pl. 75, fig. 3; pl. 76, fig. 5; pl. 77, fig. 4).

Sternellum.—The sternellum, as has been said before, is sometimes fused with epimeron. It usually also contains the precoxale and trochantin. It is always, however, distinctly separated from the coxa, to which the trochanter is loosely articulated.

Postcoxale.—In Tetrozocera a tiny strip continuing from epimeron passes behind the coxa (pl. 66, fig. 2).

Poststernellum.—In Tetrozocera there is also a small piece between the coxae, which is probably the poststerellum (postfurcasternite) (pl. 66, fig. 2).

Abdomen.—The Strepsipterous abdomen contains 10 segments, of which the first two or three are usually greatly interrupted or crowded dorsally and ventrally, but normal laterally between the postscutellum and the hypoepimeron (called femoralia by early writers). The first abdominal spiracle occurs near the anterior margin of the first segment near the lower pleurotergite of the metathorax (pl. 64, fig. 7; pl. 65, fig. 9; pl. 66, fig. 3). The other spiracles are usually difficult to find, but in *Tetrozocera santchii* there are eight abdominal spiracles (pl. 66, fig. 3).

The ninth segment is always ventrally produced beyond the tenth, which is merely a little flaplike covering of the large concavity made by the ninth. At the tip of the ninth is the oedeagus, a chitinous unpaired median tube with a subapical pore for the exertion of the penis. This oedeagus rests in the depression of the ninth and is apically covered by the flap of the tenth segment. The shape of the

oedeagus differs very greatly between genera and slightly between species (pl. 64, fig. 8; pl. 65, fig. 10; pl. 72, fig. 7; pl. 74, fig. 4; pl. 75, fig. 6; pl. 76, fig. 4; pl. 77, fig. 8; pl. 78, figs. 5, 6, 9, 12).

The tenth segment bears the anal pore. The eighth segment is in some Halictophagidae (Pentozoe, Pyrilloxenos, Delphacixenos, Pentacladocera) produced beneath the ninth segment (pl. 75, fig. 4; pl. 78, fig. 3). Otherwise, it is normal, ringlike.

CLASSIFICATION.

REASONS FOR CONSIDERING THE STREPSIPTERA AN ORDER.

Argument based on rules of establishing an order.

In 1813 Kirby set down an excellent set of four rules for the establishment of an order of insects, to which the present writer added a fifth and its converse in Bulletin 66. Taking these rules one by one we may consider the evidence supporting the contention that the Strepsiptera must be considered an order.

Rule I. *When an insect in its perfect state combines the characters of two or more orders (unless it be deemed advisable to place it in an order by itself), it should arrange with those whose metamorphosis is the same.*

The Strepsiptera do not combine the characters of any two or more orders, being easily distinguishable in either sex from all other insects. They have the usual parts belonging to the insect anatomy with certain exceptions. Some of the peculiarities of structure have counter parts in other orders, such as the flabellate antennae, the oedeagus, the ensiform mandibles, the elongate trochanters. They do not conform in type of metamorphosis with any other order, although certain features of the metamorphosis have counterparts in other orders. For instance, we find viviparous reproduction occurring here and there in other orders, but none showing it as a constant type; we find hexapod first larvae and legless later larvae in various families of Coleoptera; we find pupation in a puparium or last larval skin in Diptera and rarely in Coleoptera; we find a similar pupa in Hymenoptera; but we do not find any order in which the entire Strepsipterous type of metamorphosis is duplicated. Hence, on the basis of Rule I, we are obliged to consider the Strepsiptera an order.

Rule II. *When an insect possesses the characteristics of one order and the metamorphosis of another, in this case it should follow the characters.*

The Strepsiptera do not fit this premise in any way. There is therefore no reason under Rule II for aligning them with any other order.

Rule III. *Where an insect exhibits the metamorphosis of an order, or of a section of it but none of its characters nor those of any other*

order, it should not on that account be arranged in such order, but, on the contrary, form a distinct one.

The metamorphosis of the Strepsiptera is classed as hypermetamorphic, beginning with larviparous reproduction of free living hexapod larvae, which are conveyed by various means to the larvae of their future hosts. These hexapods after beginning the parasitic existence distend and become legless, and each succeeding molt makes the female more degenerate, while the males undergo a transformation of specialization. Both sexes exsert the head and thorax from the abdomen of the host as larvae, and the male pupa is formed within this last larval skin. The female remains imprisoned within the last larval skin and has no pupal stage, remaining absolutely larviform.

The larviparous reproduction occurs in the family Micromalthidae of the Coleoptera, in Hemiptera, in Diptera, and elsewhere in insects. There is nothing on this score to associate the Strepsiptera to any one of these orders. The hexapod larva of the Strepsiptera has its counterparts in the triungulin of the Meloidae (figs. 2, 3), the triungulinid of the Rhipiphoridae (fig. 4), the planidium type of larvae in the Hymenoptera, and especially the first larvae of the Dipterous family Cyrtidae. The larvae of *Pterodontia flavipes* Gray of the Cyrtidae are parasitic in spiders. They look more nearly like a Strepsipterous triungulinid than any of the others but are distinguished by the absence of legs. The internal chitinous structures of the Strepsipterous larvae and the backward pointing mandibles are points of resemblance to the Diptera and of separation from the Coleoptera.

However, no other insects have a metamorphosis which is similar throughout to the Strepsipterous type, and we have but one type in the entire group. Metamorphosis can not link the Strepsiptera to either the Diptera or the Coleoptera because the structure is not similar to either of these orders.

Rule IV. *Where the genera which compose an order have invariably one kind of metamorphosis, no insects that vary from it in that circumstance should be placed in it, unless they exhibit a perfect agreement with it in characters.*

The genera of Strepsiptera have invariably one type of metamorphosis. They can not therefore be placed with any other order which has a different type of metamorphosis. This precludes their being placed in the Coleoptera, Neuroptera, Diptera, or Hymenoptera, with all of which various authors have associated them. Certain Coleoptera have a type of hypermetamorphosis with points of similarity, but these Coleoptera by virtue of their characters, under Rule II, remain Coleoptera. The Strepsiptera could only be ar-

ranged with them if they exhibited a perfect agreement in characters. They do not agree with any part of the Coleoptera in their characters. Therefore by Rule IV the Strepsiptera are an order.

Rule V. *When insects formerly placed arbitrarily in some of the older orders are found by paleontology to be a distinct line of descent from the order with which they have been ranked, and show decided difference from this order in structure or in metamorphosis, they should be separated out to form a new order.*

In converse: *Insects which should be separated from an older order in accordance with any of the preceding rules, and yet which show a common origin, must also constitute a new order.*

The Strepsiptera are at least Tertiary in age, and possessed in that period all of the essential characters which so well distinguish them now from other orders. The geographic distribution of the group, in every faunal zone of the globe, especially their occurrence in the South Seas, in Australia, and the Malay Archipelago, is evidence of a very ancient origin. It is of great interest that the most primitive superfamily contains representatives in Australia, Algeria, Mexico, and Germany.

No group of insects has yet been found with which the Strepsiptera can be associated phylogenetically. They stand alone in their peculiar structure and habits.

The evidence therefore is all for their separation as a distinct order.

The assemblage of characters which distinguish the order may be summarized below. It must be understood that analogies may be found to many of these characters singly, but that the combination nowhere else is to be found.

CHARACTERISTICS DISTINGUISHING THE ORDER.

Morphological characters.

1. Dissimilarity of sexes, the male winged, hexapodal, active; the female blind, wingless, legless, inactive.

2. A regular sequence of structural modifications from primitive to highly specialized, is observable throughout the order, paralleling yet not approaching similar evolutions in other orders, and in some ways more remarkable.

3. The male thorax, which is undoubtedly the most important ordinal character, is absolutely different from the thorax of all other orders. The thorax of *Myodites solidaginis*, a Rhipiphorid, is shown in plate 69, figures 4, 5. This is the only Coleopterous family which any author has tried to ally to the Strepsiptera.

a. The prothorax and mesothorax are both greatly reduced, and the metathorax is preponderant. This is the only group of insects in which the metathorax has received the preponderance of size. Certain Coleoptera have a greatly enlarged metathorax but they also have the prothorax

greater than the mesothorax. The greatest reduction of Coleopterous thorax occurs on the mesothorax (see pl. 69, fig. 4). The greatest reduction of Strepsipterous thorax occurs on the prothorax.

b. The prothorax never consists of more than a tiny ring, but it is often crowded far forward into the head until the pleurae are reduced to mere intersegmental skin.

c. The mesothorax is a little larger than prothorax, with several small pieces, all separated by intersegmental skin. There is no strength in this segment.

d. The seat of bodily power is entirely in the metathorax, which embraces over half the body.

e. The head is separated from the thorax, and each segment of the thorax from the others by intersegmental skins; furthermore the various pieces of the prothorax and mesothorax are likewise separated. In addition to this longitudinal freedom of movement there is also great vertical freedom imparted to the body by the intersegmental areas of the pleural region. Such a bodily formation is very primitive among insects, occurring otherwise only in the lower orders of hemimetabolous insects. It indicates a very different line of descent from all the other holo-metamorphic orders.

f The metathorax displays several remarkable characteristics. The praescutum migrates from a position as a depressed neck to a poposition in the braced part of the segment and pushes backward breaking the scutum and reducing the scutellum. The scutum also shows a tendency to divide to form the parascutellum and in the extreme modification is separated from it by intersegmental skin. The postscutellum is the predominant piece in the entire body, being as large as all the rest of the thorax. No other insect known has the postscutellum thus enlarged, and it alone is sufficient to absolutely identify a Strepsipteron. At the base of the postscutellum is an area known as postlumbium, which in the more primitive groups is intersegmental, but which becomes in some genera a chitinized piece.

g. The metathorax of the Strepsiptera is far more divided than the metathorax of any other order.

h. The front wings are reduced to inflated balancers, which rapidly vibrate and assist in the making of noise. They have the rudiments of wing veins.

i. The hind wings are membranous, longitudinally folding with only radial veins. The axiliary cord is not attached directly to the scutellum, which is quite distant from the base of the wing, but to a small detached piece located on the epimeral area. The number of veins varies from eight to five.

j. The pro- and meso-coxae are free and small, the meta-coxae are larger and more broadly attached. The pro- and meso-trochanters are very long, the meta-trochanters are shorter. The femora and tibiae display no unusual characters. The tarsi are isomerous, typically five-jointed with claws, but progressively reduced to four, three and two joints without claws.

4. The male Strepsipterous head is characteristic.

a. The eyes are large, bulbous, with the ommatidia separated by partitions.

b. The antennae vary from seven- to four-jointed and always have at least the third and the last joints flabellately produced and covered with sensitive organs.

c. There is neither labrum nor labium, and the pharyngeal area is broadly exposed.

d. The mandibles are ensiform and distant from the buccal opening.

e. The maxillae are two- or three-jointed, resembling palpi, and also distant from the buccal opening.

5. The thorax has 10 segments, with the tenth serving as a flap over the extended ninth. The tenth bears the anal opening. The ninth has at its extremity an everted acute chitinous tube, with a subapical pore for the extrusion of the penis.

6. The female is permanently inclosed in the last larval skin and remains in the body of its host. It is a mere sac of eggs, larviform in appearance and legless.

a. The head and thorax are united to form a chitinous disk known as the cephalothorax. This has only a mouth opening, a pair of mandibles and one or two pair of spiracles. It is the only exposed part of the body.

b. Between the head and thorax on the venter of the cephalothorax is the opening of the brood canal, which extends between the female and the uncast skin at least to the third and sometimes to the sixth segment.

c. Entering this canal are from five to three unpaired median tubes through which the young escape into the brood canal and thus leave the parent.

7. The male pupa is of the form of the Hymenopterous pupa. It is contained within a puparium formed by the chitinization of the last larval stage. The puparium shows definite homologues of all appendages. The head forms a cap or cephalothorax, which is burst off when the male emerges.

8. The female has no pupal stage.

9. The larvae are legless, except in the first stage.

10. The first larva is active, hexapodal, with long anal stylets, with backward pointing mandibles and peculiar internal chitinization surrounding the mouth.

Internal anatomy.

11. The intestines in later stages are closed behind.

12. The nervous system is reduced to three ganglia, supraoesophageal, thoracic, and ventral. Even in the degenerate female there is a large brain.

13. The malpighian vessels and cutaneous glands are absent or greatly modified.

Biology.

14. Always hypermetamorphic:

a. Hexapod first larvae.

b. Legless degenerate later larvae.

c. Dissimilar sexual development.

d. Pupation in puparium (male).

e. No pupation in female.

15. Always parasitic, female never free.

16. Always larviparous.

17. Each morphological group confined to a definite group of hosts.

18. A type of parasitism which sterilizes but does not kill until the young parasites are free from the parent.

DESCRIPTIONS OF STREPSIPTERA.

Order STREPSIPTERA Kirby.

SYNONYMY.

Corrections to Bulletin 66, page 82:

Line 31. *Xenos*, 1793 (a genus next to Ichneumon), Rossi, 1793.

Line 32. *Phthiromyiae*, 1809 (Tribe III, Diptera), Latreille, 1809.

Line 46. *Strepsiptera*, 1859 (a family, Neuroptera Trichoptera), Gegenbaur, 1859.

Corrections to Genera Insectorum, fasc. 121, page 2:

Line 3. *Phthiromyiae*. Latreille (tribe 3, Diptera), Gen. Crust. Ins., vol. 4, p. 388 (1809).

Line 7. *Strepsiptera*. Gegenbaur (family, Neuroptera Trichoptera), 1859.

Line 11. *Stylopides*. Lacordaire (family, Coleoptera), Gen. Col., vol. 5, pp. 634–641 (1859).

In view of many new lights on the classification new descriptions are given to many groups and genera and detailed studies have been made of the transition of various characters from group to group. Notwithstanding the many new characters brought out there is no change necessary in the family classification except as to the position of Stichotrematidae. This fact amply bears out the author's original choice of superfamily and family characterizations.

Table of superfamilies of Strepsiptera.

1. Male tarsi with five joints and two tarsal claws, prothorax and mesothorax short, transverse; metapraescutum entirely in front of the scuti and not extending between them. Female unknown_____ 1. *Mengeoidea* Pierce.
   Male tarsi lacking at least one joint and claws_____ 2.
2. Female thoracic spiracles more or less easily discernible, generally prominent. Male tarsi with four joints (possibly not in Stichotrematoidea)_ 3.
   Female thoracic spiracles not usually discernible, never prominent; Homoptera parasites_____ 4.
3. Female with three rows of 12 or more genital tubes entering brood canal. Males unknown. Orthoptera parasites___ 2. *Stichotrematoidea* Hofeneder.
   Female with four of five unpaired genital tubes entering brood canal. Male tarsi with four joints; prothorax and mesothorax short, transverse. Parasites of Hymenoptera and Hemiptera_____ 3. *Xenoidea* Pierce.

4. Male tarsi with three joints; prothorax sometimes invisible at sides. Female head apically lobed; only two genital tubes entering brood canal.
4. *Halictophagoidea* Pierce.

Male tarsi with two joints. Female head with tubercles ventral, more or less obsolete; only three genital tubes entering brood canal.
5. *Elenchoidea* Pierce.

I. Superfamily MENGEOIDEA Pierce.

This superfamily is characterized in the male by its five-jointed tarsi with two tarsal claws and is therefore the most generalized type in the order. The metathorax also shows the simplest characters, the five known genera all having the praescutum entirely anterior to the scutum and scutellum. In the family Mengeidae the praescutum is bandlike and similar to the pronotum and mesonotum. In the family Mengenillidae the praescutum is depressed necklike.

Two families, five genera, six species.

Germany, Algeria, Australia, Texas, Mexico.

Hosts unknown; females unknown.

Table of families of Mengeoidea.

Antennae seven-jointed, third and fourth joints laterally produced; metathoracic praescutum transverse, reaching humeri; scuti entirely behind praescutum; scutellum broadly rounded in front, longer than praescutum; postlumbium very short and transverse_____ 1. *Mengeidae* Pierce.

Antennae six-jointed, third, fourth, and fifth joints laterally produced, sixth elongate; metathoracic praescutum transverse quadrate, not reaching humeri, depressed and serving as a sort of neck; scuti at humeral angles reaching mesothorax; scutellum very long, narrowed and rounded in front; postlumbium about as long as broad_____ 2. *Mengenillidae* Hofeneder.

It is quite possible that the families Stichotrematidae and Callipharixenidae, described from females, may correspond with these families base on males.

1. Family MENGEIDAE Pierce.

This family is characterized by five-jointed tarsi with claws; seven-jointed antennae with the third and fourth joints laterally prolonged; large eye facets distinctly separated one from another; transverse metapraescutum not prolonged behind between scuti; postlumbium short, transverse; abdomen with 10 segments, the first eight normal, the ninth ventrally prolonged and bearing the oedeagus at apex, the tenth serving as a flaplike covering of the ninth and containing the anal opening.

The scuti are narrowly connected in front of the scutellum in *Mengea tertiaria*, but in Triozocera they are narrowly connate with the praescutum at the sides of and in front of the scutellum.

Table of genera of Mengeidae.

Wings having eight primary veins from base, with one distal detached vein between radius and medius and with the second and third anal veins apically united and a detached anal vein beyond these; fifth and sixth antennal joints short, not much longer than first and second ..... 1. *Mengea* Grote.

Wings having eight primary veins from base, with one distal detached vein beyond the tip of the radius, medius with two detached branches, third anal faint; fifth and sixth antennal joints elongate ..... 2. *Triozocera* Pierce.

1. Genus MENGEA Grote.

Correction to Bulletin 66, p. 207:

Lines 17, 18, 19. Grote, Augustus Radcliffe. *1886. (Changes *Triaena* Menge preoccupied, to *Mengea*, new name), Can. Ent., vol. 18, p. 100.

Corrections to Genera Insectorum:

Page 8, last line. *Mengea.* Grote, The Canad. Entom., vol. 18, p. 100 (1886).

Page 9, lines 14–16. *Mengea tertiaria*, Grote, The Canad. Entom.. vol. 18, p. 100 (1886); Pierce, Bull. U. S. Nat. Mus. No. 66, p. 84, pl. 1, fig. 1 (1909); Hofeneder, Bericht. Naturw. Med. Ver. Innsbruck, vol. 32, pp. 33–57, figs. 10–15 (1910).

This genus contains one species, which was found fossil in amber in Germany.

1. MENGEA TERTIARIA Grote.

The study of thoracic characters has enabled the writer to make an interpretation of Menge's drawing and description of this species. This drawing is necessarily arbitrary, but differs from Menge's mainly in the addition of the postlumbium (pl. 64, fig. 1).

This species differs principally from *Triozocera* by the length of the last three antennal segments. In *Mengea* the fifth and sixth joints are short, the seventh longer. In *Triozocera* these three joints are subequal and elongate, the sixth being a little shorter than the others.

2. Genus TRIOZOCERA Pierce.

This genus has several interesting characteristics. The facets of the eyes are large and well separated. The head is not crowded. The mandibles are reduced to a tiny chitinous filament and the maxillae are one-jointed. The pronotum is arched forward in *texana*, but not in *mexicana*. It is a simple band in both species. Mesonotum is composed of two indistinctly separated transverse pieces. The metascuti are not or at most only partially divided transversely to form the parascutellar pieces. The mesopleurum is enlarged to form a lobe under the base of the elytra, beneath which is the spiracular opening. This location of the spiracle is entirely analogous to that in *Xenos*. The tiny pro- and meso-coxae are loosely attached to lateral hooks, which are apparently a fusion of trochantin, episternum, and epimeron. The pro- and meso-trochanters are elongate. The meta-

coxae terminate the sternum, being contiguous medially, and bear the trochanters, which are much shorter than those of the other two pair of legs.

Table of species of Triozocera.

1. Prothorax arched forward; first abdominal spiracle distinctly on the first abdominal segment; host unknown; Texas_____*texana* Pierce.
2. Prothorax not arched forward; first abdominal spiracle on the suture between epimeron and first abdominal segment; host unknown; Mexico_____ _____*mexicana* Pierce.

TRIOZOCERA TEXANA Pierce.

Plate 64, figs. 2–10.

This species has served to make *Mengea tertiaria* intelligible, as it differs mainly in antennal and wing characters. Unfortunately the specimen was caught at light and the head was singed, loosing its antennae (the antennae in Pl. I, fig. 10, are reconstructions based on *T. mexicana*). Otherwise the type is perfect and gives a fine understanding of the most primitive characters in the order. By tracing the descriptions through the paper it will be apparent that the scutum in later families has become medially separated by the backward crowding of the praescutum and that the parascutellum is the result of a transverse fision of scutum. Other modifications also become clear. The thoracic structure of this genus is therefore given below in considerable detail.

Prothorax with notum arched forward, simple. Sternum lobate at anterior angles, the lobe possibly a part of episternum. Presternite tiny, triangular. Eusternum short, transverse, united laterally to episternum, which is prolonged posteriorly in the form of a hook, at the apex of which coxa is attached. This hook probably also contains trochantin and epimeron. The sternellum (furcasternite) is medially divided by a strong black line, which forms an inverted T with the posterior margin. The poststernellum is a tiny area behind the sternellum. The remainder of the sternum is composed of soft intersegmental skin, which extends forward into the coxal area. The tiny coxa appearing like a tiny basal piece of trochanter is attached to the pleural hook and by a tiny filament to a little hook at the side of the sternellum. The trochanter, femur, tibia, and first tarsal joint are elongate; second and third tarsal joints together about equal to the first, pubescent and cylindrical; fourth joint short, inferiorly lobate pulvilliform; fifth joint arising about the middle of fourth, more slender and armed with two minutely dentate, curved ungues.

Mesothorax with notum of a single piece faintly divided by a transverse fold. The anterior part is divided by its pubescence into a central area and two anterior lateral triangular pieces. The latter are probably the praescutum and the central piece the scutum.

Behind the transverse fold is the scutellum and at the apex folded in, is the transverse postscutellum. The posterior angles are elongate, passing beneath. Below the attachment of the clavate elytra the pleuri are greatly inflated, lobate, with the anterior margin granulate, three edged, and immediately below a small elytral hook. The sternum is divided into four parts, the pleurum is fused into one. The anterior piece on the median line is a very narrow transverse strip (eusternum) enlarging very greatly toward the side. This latter area is strongly depressed and distinctly margined behind by the inner edge of the pleural lobe. The depression becomes deepest at the acute posterior corner and appears to be diagonally cleft to form a spiracular opening. In fact on focusing, the trachea can be seen terminating practically at this cleavage. The pleural area (trochantin+episternum+epimeron) behind the angle of the so-called spiracular orifice narrows into a curved hook to which the coxa is attached. Behind the eusternum the sternellum is medially divided by a strong inverted T as on the presternum. The post sternellum is a transverse area behind the sternellum. The coxa appears as a small basal piece to the trochanter. The legs are as in pronotum.

Metathorax almost four times as large as prothorax and mesothorax combined. Notum consists of praescutum, prelare, scutum, scutellum, postlumbium and postscutellum. The praescutum is convex on anterior margin and lies entirely in front of the scutum. Scutum is narrowly connected with praescutum at apex of scutellum. A faint line on each side separates the suralare. Scutum is divided to form parascutellum by a line from base of wing. Scutellum is elongate subtriangular.

Opposite the base of the scutellum on the epimeron there is a tiny lobe, to which is attached the axillary cord. This is a detached part of scutellum. Behind this little piece the epimeral area is enlarged and continues unbroken to the coxae and behind them, and is fused with the sternellum in front of the coxae. This large area may be called hypoepimeron to the coxae, and postcoxale behind them. A faint color line separates presternum from eusternum, and a faint fold the eusternum from sternellum. The coxae are conical pieces and are contiguous on the median line. The trochanters are shorter than for the other two pair. Femur, tibia, and first tarsal joint are elongate.

The first abdominal spiracle is distinctly on the first abdominal segment, but near the edge of the hypoepimeron.

The oedeagus is slightly sinuate, acute.

The wings have a faint indication of the third anal vein, so the generic description is changed in the key to read with eight primary veins. This is made clear in the drawing of the venter which shows the bases of the wings.

TRIOZOCERA MEXICANA Pierce.

Plate 65, figs. 1–10.

Only two specimens of this species occur, the type in the United States National Museum collection and the paratype in the author's private collection at the museum.

New drawings have been made to illustrate the thoracic characters.

By the use of improved microscope accessories the mouth parts have been studied. These are very aberrant, the mandibles being reduced to a tiny filament and the maxillae being long pubescent appendages with a small second joint attached before the tip (pl. 65, figs. 4, 5).

The antennal structure is very rough, consisting of round sensory organs surrounded by setigerous tubercles (pl. 65, fig. 3).

The description of *texana* will fit this species in general. It is important to note that the author's illustration in Genera Insectorum (pl. 1, fig. 1) was in error as to the shape of the scutellum. The specimen was mounted slightly on its side and hence not easily studied.

II. Family MENGENILLIDAE Hofeneder.

Erratum: Gen. Insect., p. 10, line 2, read "Vol. 32" for "Vol. 31."

This family is characterized in addition to the six-jointed, four-branched antennae, and five-jointed tarsi, by an emargination of the head, a metathoracic praescutum placed entirely in front of the scutum and not reaching the lateral angles: a very large meta coxa; and a large postlumbium.

Table of genera.

1. Scutum divided by scutellum ..... 2.
   Scutum narrowly connected in front of scutellum ..... *Tetrozocera* Pierce.
2. Scutellum broad in front; wings lacking the third anal vein, with two detached veins between radius and medius and one behind medius; mandibles triangular ..... *Austrostylops* Lea.
   Scutellum narrow in front; wings lacking two anal veins, with two detached veins between radius and medius and one behind medius; mandibles elongate, acute ..... *Mengenilla* Hofeneder.

3. Genus MENGENILLA Hofeneder.

Errata: Gen. Insect., pp. 10, 11, 16, 29, read "Vol. 32" for "Vol. 31."

MENGENILLA CHOBAUTII Hofeneder.

Plate 66, figs. 6, 7.

Because of Hofeneder's misinterpretation of the parts of the thorax the writer has made drawings based on the original illustrations to serve as an aid to the proper understanding of the following remarks.

It is apparent from Hofeneder's drawings that this insect has

structures strictly analogous to those of the other species in the family.

The pronotum is simple. The mesonotum is simple, with small lateral basal pieces. Metanotum has the praescutum raised to the level of the remainder of the metathorax and slightly angulate behind. The scuti are narrowly separated by the scutellum. The postlumbian is very large and the postscutellum relatively small. At the side of postscutellum are two small pleurotergite areas, the lower of which was called epimeron by Hofeneder. The prelare is a large piece and was considered part of episternum by Hofeneder. Episternum is longitudinally divided, but only the lower lobe or lateropleurite was recognized as episternum by Hofeneder. The pleural suture extends to the coxae. The epimeron is a large strip from wing to coxa, the front part of which was called parapleuron by Hofeneder, and in his figure "6*a*" the part labeled "*st.*" is the hypoepimeron. Hofeneder figures the little triangular piece on epimeron, which the writer considers a detached piece of scutellum, to which the axillary cord is attached, as described under *Triozocera*.

The prosternum has a tiny eusternum and a transverse sternellum, biemarginate, with the coxae attached at the outer angles of the emargination.

The mesosternum has a transverse presternum and a transverse eusternum, which is fused with episternum. The sternellum is as in the prothorax.

The metasternum is large and not divided transversely, but with the usual longitudinal division of the sternellar area. The epimeron extends as a postcoxale behind the coxae. The coxa is a very large lobate area bearing the trochanter.

4. Genus AUSTROSTYLOPS Lea.

Plate 66, fig. 5.

Lea's figure of *Austrostylops gracilis* is so poor that it is impossible to interpret adequately the thoracic scelerites. The writer has made a drawing in which a slight interpretation of Lea's original is added.

5. TETROZOCERA, new genus.

Type of the genus.—*Tetrozocera santchii*, new species.

Name derived from τέτρα (four) + ὄζος (branch) + κέρας. (horn) = four branched antennae.

Male.—Head transverse; eyes large, prominent, with many large facets. Mandibles large, flattened, triangular; maxillae two-jointed, elongate. Antennae six-jointed, sensitive, with the third, fourth, and fifth joints laterally produced and the sixth elongate. Prothorax and metathorax transverse. Elytra subclavate. Metathorax very

large, with praescutum small, necklike, depressed, and almost concealed by mesothorax and scutum. Scutum narrowly connected in front of the broadly rounded scutellum. There is no indication of a fission to form the parascutellum. Postlumbium large, postscutellum relatively smaller than usual. Wings with two anal veins lacking. There are two small detached veins between radius and medius, but none behind medius. Tarsi five-jointed, armed with two long claws.

Female.—Unknown.

Hosts.—Unknown.

TETROZOCERA SANTCHII, new species.

Plate 66, figs. 1–4.

Described from a single male collected by F. Santchi at Kairouan, Algeria, in August, 1907.

This species differs from *Mengenilla chobautii* Hofeneder, also of Algeria in the following characteristics: The praescutum is depressed, not raised to the disk. The scuti are connected, not separated by the scutellum. The scutellum is broadly rounded, not acute at apex. The head is broadly emarginate, not sharply. The eyes are diagonal, elongate, not rounded when seen from above.

The specimen had been rather badly treated, having been originally in alcohol and later dry mounted. One wing is missing. It has been impossible to locate the tiny scutellar triangle on the epimeron, but it may be present. This is the first specimen in the order in which the abdominal spiracles have all been visible. They are quite large on all but the eighth segment. The first is located just below the suture, between the lower lateropleurite and the epimeron, but entirely on the first segment. The lateropleurite extends forward almost to the wing.

Type.—Cat. No. 21434, U.S.N.M.

II. Superfamily STICHOTREMATOIDEA Hofeneder.

III. Family STICHOTREMATIDAE Hofeneder.

6. Genus STICHOTREMA Hofeneder.

1. STICHOTREMA DALLATORREANUM Hofeneder.

Plate 67.

Parasite of *Sexava nubila* Stal; Admiralty Islands, and of *Sexava*, species; Schouten Islands.

Triungulinid: Described from paratype specimens from Schouten Islands, sent the author by Doctor Hofeneder. Oblong, with transverse quadrate head; subequal thoracic segments; eight simple abdominal segments; the ninth dorsal being very long and covering the tenth, quadrate, with apical angles armed with short bristles and

with two apical tubercles bearing long bristles; ninth ventral short quadrate with setigerous tubercles at apical angles; tenth apical, dorsally covered by ninth, armed with a very long pair of approximate bristles; tarsi consisting of single-jointed pads.

Head apically emarginate, containing very peculiar internal chitinizations. The mouth opening causes an emargination of the apex. This is braced by a ventral bridge which sends forward an arm on each side of the mouth and also two similar arms backward. This chitinization extends dorsally and forms an elliptical orifice for the esophagus. Externally lying over this chitinization and apparently connected with it is a four-pronged piece with at least three of the prongs prominent when viewed from the side (illustrated in pl. 67, fig. 3). The mandibles are also peculiar. They are attached apparently to the anterior arms of the ventral bridge and extend laterally almost to the eyes and have a long tooth extending to the base of the head. The antennae appear to be three jointed and are placed near the anterior margin about halfway between mouth and ocelli. The second joint has a long lateral arista. The ocelli are in three pairs, the anterior being immense in comparison to the size of the head. The crystalline lens is convex and beneath it at some distance are clusters of pigment granules. Two smaller ocelli lie behind this as shown in figure 3, plate 67.

Paratypes.—Cat. No. 21435, U.S.N.M.

III. Superfamily XENOIDEA Pierce.

Table of families.

1. Male unknown. Female cephalothorax narrow and elongated with two pair of spiracles; five genital tubes entering brood canal. Parasites of Heteroptera ..... IV. *Callipharixenidae*, new family.
   Males known. Female cephalothorax broader, with only a single pair of spiracles 2
2. Scutellum broadly rounded in front 3
   Scutellum more or less broadly truncate, and pedunculate in front 4
3. Scutellum shorter than praescutum; postlumbian short, transverse; antennae seven-jointed, third joint laterally produced, fourth joint short, fifth to seventh joints elongate. Female unknown. Parasites of Formicoidea ..... V. *Myrmecolacidae* Pierce.
   Scutellum longer than praescutum; postlumbium at least half as long as broad; antennae six-jointed, the third joint laterally produced. Female cephalothorax broadly truncate or rounded at apex; head almost one-half as wide as metathorax at spiracles; five genital tubes entering brood canal. Parasites of Apoidea ..... VI. *Stylopidae* Kirby.
4. Praescutum as broad as mesothorax at base; antennae five-jointed, the third joint laterally produced, fourth very short, fifth elongate. Female cephalothorax with head not more than one-half as wide as metathorax at spiracles. Parasites of Apoidea ..... VII. *Hylecthridae* Pierce.
   Praescutum not as broad as mesothorax at base; antennae four-jointed, the

third joint laterally produced, fourth joint elongate. Female cephalothorax variable in shape, four or five genital tubes entering brood-canal. Parasites of Xenoidea, Sphecoidea, and Apoidea_____VIII. *Xenidae* Semenov.

IV. CALLIPHARIXENIDAE, new family.

Female cephalothorax elongate, with margin distinctly indicating thoracic segments, mesothoracic and metathoracic spiracles present, not surpassing the margin; brood canal extending to apex of sixth abdominal segment and apparently with five median unpaired genital tubes.

Triungulinid with seven simple abdominal segments, eighth dorsally enlarged, ninth greatly enlarged and partially enclosing the tenth which is terminated by two long stylets. Shorter hairs at sides of ninth. Tarsi one-jointed with three filaments or claws.

Includes two genera and two species.

1. *Calliphariхenos* Pierce, type *muiri* Pierce; parasitic on *Calliphara;* Amboina.

2. *Chrysocorixenos* Pierce, type *siamensis* Pierce; parasitic on *Chrysocoris;* Siam.

7. CALLIPHARIXENOS, new genus.

Female with five unpaired median tubes and two pair of cephalothoracic spiracles; cephalothorax very elongate not narrowing perceptibly until base of head is reached.

Parasites of the Scutellarid genus *Calliphara.*

Type of the genus.—Calliphariхenos muiri, new species; Amboina; *Calliphara billiardierei* Fabricius.

1. CALLIPHARIXENOS MUIRI, new species.

Plate 68, figs. 2–7.

Described from three females extracted from specimens of *Calliphara billiardierei* Fabricius, collected in Amboina by F. Muir, under his number 388. One female contained two female parasites in the fifth ventral segment and a male contained one female in the fifth ventral. Triungulinids were present.

Female (pl. 68, figs. 2, 3).—Entire body 8 mm. long, cephalothorax 1.2 mm. long, about 0.6 mm. wide. Abdomen with five unpaired median genital tubes. Cephalothorax elongate with two pair of spiracles opening on the sides. The measurements are based on the metathoracic spiracles as usual. The sides of the head extend backward and inclose the prothorax. The first abdominal segment is also apparently a part of the cephalothorax, separated by slight constriction. Mandibles subquadrate with tooth at inner apical angle.

From this point on whenever females are measured the following dimensions are taken with the aid of a Bausch and Lomb microscope,

160 mm. tube length, 1 inch eyepiece micrometer, 16 mm. objective. The measurements represent spaces on the micrometer scale in which one space =0.0149 mm.

The measurements are given by number as follows:

1. Breadth of cephalothorax at spiracles.
2. Breadth of head at base.
3. Breadth of head at base of mandibles.
4. Breadth of basal constriction of cephalothorax.
5. Length from anterior edge of spiracles to apex.
6. Length from base to apex.

These measurements are also given in a second table under each species comparing them proportionately with measurement No. 1. (See text fig. 5, p. 406.)

Table of measurements.

Measurements	1	2	3	4	5	6	Index total.
Type	47	45	17	36	50	69	.....
Relative length compared to breadth at spiracles	1.00	0.95	0.36	0.76	1.06	1.47	5.60

This shows what a different mathematical formula this species has from the genus Stylops.

Triungulinid (pl. 68, figs. 4–7): Elongate, hexapodal. Head transverse, emarginate, with five ocelli in a dark patch on each side. These ocelli are completely separated, perfect, simple eyes with rather large lenses and the outline of the entire eye darkened. The crystal body is funnel shaped, extending through the ocellus. Mandibles elongate, slender, curved, turned backward, and apparently with an opening in the enlarged tip. The pharyngeal skeleton is much more slender than in *Stichotrema*, consisting of an arched piece and two almost straight diverging rods. The antennae are very indistinct even with the highest power magnification, but seem to be composed of two joints and a filament.

The coxae are very large; femora and tibiae apically spined; tarsus one jointed, terminated apparently by three slender filaments. This is a very unusual type of tarsus for Strepsiptera. The eighth, ninth, and tenth segments of the abdomen are greatly modified. The eighth laterally extends almost to the apex of the ninth, but is dorsally emarginate and ventrally is normal. The ninth incloses the tenth, which bears a pair of stylets.

Types (female and triungulinids).—Cat. No. 21436, U.S.N.M.

8. CHRYSOCORIXENOS, new genus.

Female with five unpaired genital tubes, and two pair of cephalo thoracic spiracles. Cephalothorax very elongate, only narrowing in front of base of head.

Parasites of the Scutellarid genus *Chrysocoris*.

Type of the genus.—*Chrysocorixenos siamensis*, new species; Siam; *Chrysocoris grandis* Thunberg.

1. CHRYSOCORIXENOS SIAMENSIS, new species.

Plate 68, fig. 1.

Described from one female from a specimen of *Chrysocoris grandis* Thunberg, from Siam.

Female.—Brood canal extends to apex of sixth segment and segments 2–6 have median unpaired genital tubes. Cephalothorax apparently includes first abdominal segment with slight constriction at base of thorax. Two pair of cephalothoracic spiracles. Head prolonged behind at sides.

Table of measurements.

Measurements	1	2	3	4	5	6	Index total
Type	62	58	21	40	60	85	.....
Relative length compared to breadth at spiracles	1.00	0.93	0.34	0.64	0.96	1.37	5.24

Type.—Cat. No. 21437, U.S.N.M.

V. Family MYRMECOLACIDAE Pierce.

Table of Genera.

Wings short in proportion to body, with eight primary veins; fifth and sixth antennal joints subclavate; tenth dorsal abdominal segment small, not concealing oedeagus and anal cavity ..... 9. *Myrmecolax* Westwood.

Wings long, with only six primary veins from base, the cubitus and third anal missing, with a short detached vein just below the apex of the radius, medius short and continued by a long detached vein beginning behind it and shortly before its apex; fifth and sixth antennal joints slender throughout; tenth dorsal segment very large, completely covering oedaegus and anal cavity. 10. *Caenocholax* Pierce.

9. Genus MYRMECOLAX Westwood.

1. *M. nietneri* Westwood; parasite of formicid; Ceylon.

10. Genus CAENOCHOLAX Pierce.

1. *C. fenyesi* Pierce; host unknown; Mexico.

1. CAENOCHOLAX FENYESI Pierce.

Plate 69, figs. 1–3.

Errata: Gen. Insect., p. 14, last line, add "Pl. 1, unnumbered figures"; p. 52, lines 14, 15, read "4" for "3."

The dorsal portions of the thorax of this species are adequately described in previous papers, but a few points ought to be empha-

sized at this time. The mesonotum is distinctly divided into three transverse areas. The pronotum is pushed far forward between the eyes. The metathoracic scutum is not divided by praescutum and scutellum. Parascutellum is completely separated from scutum.

The pleural plates of the prothorax and mesothorax are conspicuous, and ventrally are united with the eusternum. The sternellum is, as usual, longitudinally strongly marked on the median line. The front and middle trochanters are normally elongate.

The metathoracic pleurae are greatly twisted. The prelare is a large piece indistinctly separated from the lower lobe of the episternum (lateropleurite). The epimeron is narrow in front but very large in the hypoepimeral zone. The pleural suture is very sinuous and reaches the coxae. Episternum does not come near the coxae, being terminated as usual in this order, far forward. The sternum is indistinctly marked into two areas. The coxa is large and bears a very small trochanter. The hind femora are short and broad.

VI. Family STYLOPIDAE Kirby.

As now characterized, the family Stylopidae has in the male six-jointed antennae, with only the third joint laterally produced; four-jointed tarsi without claws; metathoracic praescutum extending between scuti but not always separating them; postlumbium rather large; parascutellum distinct; and in the female, five genital tubes, distinct mandibles, distinct spiracles.

The following genera and subgenera are included:

Stylops Kirby 1802, type, *melittae* Kirby; 50 species.

Subgenus *Stylops* Kirby; 48 species.

Subgenus *Katastylops* Pierce, type, *polemonii* Pierce; 1 species.

Subgenus *Prostylops* Pierce, type, *pilipedis* Pierce; 1 species.

Neostylops Pierce, type, *crawfordi* Pierce; 5 species.

Parastylops Meijere 1908, type, *flagellatus* Meigere; 1 species.

Table of genera of Stylopidae (Males).

1. Metathoracic scutum not divided by praescutum and scutellum ..... 2.
   Metathoracic scutum divided by praescutum and scutellum; antennae short and robust ..... 11. *Stylops* Kirby.
2. Antennae short and robust ..... 12. *Neostylops* Pierce.
   Antennae attenuate ..... 13. *Parastylops* Meijere.

Table of species of female Stylopidae.

1. (*a*) Spiracles not reaching margin ..... 2.
   (*b*) Spiracles reaching margin ..... 3.
2. (*a*) Mandibles with an apical tooth and a strong lateral tooth near base; base of head 0.61 as wide as cephalothorax at spiracles; distance from spiracles to apex 0.71 the breadth at spiracles (*Stylops*, group 1) ..... *bipunctatae.*

(*b*) Mandibles broad, subquadrate, with apical tooth; base of head 0.62 as wide as cephalothorax at spiracles; distance from spiracles to apex 0.80 the breadth at spiracles (*Stylops*, group 1)_____*moestae.*

3. (*a*) Spiracles not prominent_____ 4.
   (*b*) Spiracles prominent_____ 23.
4. (*a*) Mandibles without tooth_____ 5.
   (*b*) Mandibles toothed_____ 8.
5. (*a*) Cephalothorax broader than long_____ 6.
   (*b*) Cephalothorax longer than broad_____ 7.
6. (*a*) Base of head 0.56 as wide as cephalothorax at spiracles; base of cephalothorax 0.65 breadth at spiracles; length of cephalothorax only 0.94 breadth at spiracles (*Neostylops*, group 1)_____*crawfordi.*
   (*b*) Base of head 0.61 as wide as cephalothorax at spiracles; base of cephalothorax 0.80 breadth at spiracles; length of cephalothorax 0.96 breadth at spiracles (*Stylops*, group 2)_____*mandibularis.*
7. (*a*) Base of head 0.60 as wide as cephalothorax at spiracles; base of cephalothorax 0.72 breadth at spiracles; length of cephalothorax 1.10 breadth at spiracles; very small (*Katastylops*)_____*polemonii.*
   (*b*) Base of head 0.67 as wide as cephalothorax at spiracles; base of cephalothorax 0.74 breadth at spiracles; length of cephalothorax 1.03 breadth at spiracles; very large (*Prostylops*)_____*pilipedis.*
8. (*a*) Mandibles with only one tooth, not angulate on side_____ 9.
   (*b*) Mandibles with an apical tooth, and an angulation or tooth on side__ 17.
9. (*a*) Cephalothorax broader than long_____ 10.
   (*b*) Cephalothorax as long as, or longer than, broad_____ 11.
10. (*a*) Mandibles subquadrate with tooth at inner apical angle; base of head 0.51 as wide as cephalothorax at spiracles; base of cephalothorax 0.67 breadth at spiracles; length of cephalothorax 0.87 breadth at spiracles (*Stylops*, group 3)_____*nubeculae.*
    (*b*) Mandibles rounded with tooth near apex; base of head 0.62 as wide as cephalothorax at spiracles; base of cephalothorax 0.54 breadth at spiracles; length of cephalothorax 0.97 breadth at spiracles (*Stylops*, group 4)_____*subcandidae.*
11. (*a*) Cephalothorax as long as broad_____ 12.
    (*b*) Cephalothorax longer than broad_____ 15.
12. (*a*) Mandibles elongate rounded_____ 13.
    (*b*) Mandibles subquadrate_____ 14.
13. (*a*) Mandibles with tooth on inner side, surpassed by apex; base of head 0.58 as wide as cephalothorax at spiracles; base of cephalothorax 0.74 breadth at spiracles; spiracles lateral, hardly prominent (*Stylops*, group 5)_____*krygeri.*
    (*b*) Mandibles with acute tooth at apex; base of head 0.58 as wide as cephalothorax at spiracle; base of cephalothorax 0.82 breadth at spiracles; spiracles lateral, convex, but not strongly prominent (*Stylops*, group 6)_____*multiplicatae.*
14. (*a*) Tooth of mandible near inner apical angle; base of head 0.56 as wide as cephalothorax at spiracles; base of cephalothorax 0.87 breadth at spiracles; spiracles barely marginal (*Stylops*, group 6)____*advarians.*
    (*b*) Tooth of mandible apical; base of head 0.60 as wide as cephalothorax at spiracles; base of cephalothorax 0.78 breadth at spiracles; spiracles lateral, but not prominent (*Stylops*, group 6)_____*bisalicidis.*
    (*c*) Tooth of mandible halfway between apical angles; base of head 0.62 as wide as cephalothorax at spiracles; base of cephalothorax 0.80 breadth at spiracles; spiracles slightly convex on margin but not prominent (*Stylops*, group 6)_____*sparsipilosae.*

15. (*a*) Mandibles rounded with apical tooth ..... 16.
(*b*) Mandibles emarginate at apex with strong outward curved tooth at inner angle and outer angle rounded; spiracle slightly convex but not prominent; base of head 0.56 to 0.65 as wide as cephalothorax at spiracles; base of cephalothorax 0.71 to 0.78 breadth at spiracles; length of cephalothorax 1.02 to 1.18 breadth at spiracles (*Stylops*, group 7) ..... *crigeniae.*

16. (*a*) Base of head 0.64 as wide as cephalothorax at spiracles; base of cephalothorax 0.79 breadth at spiracles; length of cephalothorax 1.03 breadth at spiracles; spiracles barely marginal (*Stylops*, group 8) ..... *hippotes.*
(*b*) Base of head 0.55 as wide as cephalothorax at spiracles; base of cephalothorax 0.77 breadth at spiracles; length of cephalothorax 1.06 breadth at spiracles; spiracles laterally slightly convex but not prominent (*Stylops*, group 8) ..... *nasoni.*

17. (*a*) Mandibles two-angled at apex and slightly emarginate between, not distinctly toothed; base of head 0.66 as wide as cephalothorax at spiracles; base of cephalothorax the same; length of cephalothorax 1.03 breadth at spiracles; spiracles barely marginal (*Stylops*, group 9) ..... *swenki.*
(*b*) Mandibles toothed at apex and angled on outer side ..... 18.

18. (*a*) Cephalothorax as long as broad; spiracles barely marginal (*Stylops*, group 10) ..... *claytoniae* 19.
(*b*) Cephalothorax longer than broad ..... 20.

19. Varieties of *S. claytoniae;* base of cephalothorax 0.68 breadth at spiracles.
(*a*) Mandibles rounded with apical tooth and slight angle on outer side; base of head 0.54 as wide as cephalothorax at spiracles. var. *claytoniae.*
(*b*) Mandibles subquadrate with tooth near inner apical angle and with strong angle near middle of outer side; base of head 0.58 as wide as cephalothorax at spiracles ..... var. *imitatrix.*
(*c*) Mandibles strongly two-toothed; base of head 0.64 as wide as cephalothorax at spiracles ..... var. *vierecki*

20. (*a*) Lateral angle of mandible not toothlike 21
(*b*) Lateral angle of mandible toothlike and subbasal 22

21. (*a*) Base of head 0.56 to 0.59 as wide as cephalothorax at spiracles; base of cephalothorax 0.66 breadth at spiracles; length of cephalothorax 1.07 breadth at spiracles (*Stylops*, group 11) ..... *bruneri.*
(*b*) Base of head 0.59 as wide as cephalothorax at spiracles; base of cephalothorax 0.70 breadth at spiracles; length of cephalothorax 1.09 breadth at spiracles (*Stylops*, group 11) ..... *oklahomae.*
(*c*) Base of head 0.60 as wide as cephalothorax at spiracles; base of cephalothorax 0.80 breadth at spiracles; length of cephalothorax 1.06 breadth at spiracles (*Stylops*, group 11) ..... *salictariae.*
(*d*) Base of head 0.62 as wide as cephalothorax at spiracles; base of cephalothorax 0.73 breadth at spiracles; length of cephalothorax 1.04 breadth at spiracles (*Stylops*, group 11) ..... *andrenoides.*
(*e*) Base of head 0.61 as wide as cephalothorax at spiracles; base of cephalothorax 0.75 breadth at spiracles; length of cephalothorax 1.08 breadth at spiracles; outer apical angle of mandible strongly rounded, apex emarginate between angle and tooth (*Stylops*, group 11). *medionitans.*

22. Base of head 0.57 as wide as cephalothorax at spiracles; base of cephalothorax 0.69 breadth at spiracles; length of cephalothorax 1.08 breadth at spiracles (*Neostylops*, group 2)_____*solidulae.*

23. (*a*) Mandibles with apical tooth or sharp angle, but without lateral angle_ 24

(*b*) Mandibles with apical tooth and an angle on lateral margins_____ 29

24. (*a*) Cephalothorax broader than long or exactly as long as broad; base of head 0.59 as broad as cephalothorax at spiracles_____ 25

(*b*). Cephalothorax longer than broad_____ 26

25. (*a*) Mandibles broadly rounded, toothed near inner apical angles; breadth at base of mandibles 0.40 as broad as cephalothorax at spiracles; base of cephalothorax 0.77 breadth at spiracles (*Stylops*, group 12)_____*sinuatus.*

(*b*) Mandibles subquadrate with apical tooth pointed outward; breadth at base of mandibles 0.31 as broad as cephalothorax at spiracles; base of cephalothorax 0.73 breadth at spiracles (*Stylops*, group 12)_____*grandior.*

(*c*) Mandibles narrowly rounded, toothed at apex; breadth at base of mandibles 0.36 as broad as cephalothorax at spiracles; base of cephalothorax 0.74 breadth at spiracles (*Stylops*, group 12)___*nudae.*

26. (*a*) Mandibles merely angulate at apex; breadth of head 0.67 as wide as cephalothorax at spiracles; breadth of cephalothorax at base 0.83 breadth at spiracles; length of cephalothorax 1.07 breadth at spiracles (*Stylops*, group 13)_____*salicifloris.*

(*b*) Mandibles distinctly toothed at apex_____ 27

27. (*a*) Mandibles subquadrate with outward pointing tooth_____ 28

(*b*) Mandibles rounded with apical tooth; base of head 0.52 to 0.56 as wide as cephalothorax at spiracles; base of cephalothorax 0.69 breadth at spiracles (*Stylops*, group 12)_____*cornii.*

28. (*a*) Base of head 0.60 to 0.63 as wide as cephalothorax at spiracles; distance from spiracles to apex 0.64 to 0.68 breadth at spiracles (*Stylops*, group 12)_____*californica.*

(*b*) Base of head 0.57 to 0.64 as wide as cephalothorax at spiracles; distance from spiracles to apex 0.69 to 0.74 breadth at spiracles (*Stylops*, group 12) _____*vicinae.*

29. (*a*) Cephalothorax broader than long; breadth of head 0.53 as wide as cephalothorax at spiracles; of cephalothorax 0.69 breadth at spiracles; length of cephalothorax 0.92 breadth at spiracles (*Stylops*, group 14)_____*graenichcri.*

(*b*) Cephalothorax longer than broad_____ 30.

30. (*a*) Breadth of head 0.53 as wide as cephalothorax at spiracles; base of cephalothorax 0.83 breadth at spiracles; length of cephalothorax 1.04 breadth at spiracles (*Stylops*, group 15)_____*cressoni.*

(*b*) Breadth of head 0.56 as wide as cephalothorax at spiracles; base of cephalothorax 0.77 breadth at spiracles; length of cephalothorax 1.04 breadth at spiracles (*Stylops*, group 15)_____*diabola.*

(*c*) Breadth of head 0.60 as wide as cephalothorax at spiracles; base of cephalothorax 0.86 breadth at spiracles; length of cephalothorax 1.06 breadth at spiracles (*Stylops*, group 16)_____*hartfordensis.*

(*d*) Breadth of head 0.61 as wide as cephalothorax at spiracles; base of cephalothorax 0.71 breadth at spiracles; length of cephalothorax 1.04 breadth at spiracles (*Stylops*, group 16)_____*neonanae.*

Arrangement of female stylopidae according to breadth of cephalothorax at spiracles.

polemonii	34.5	*claytoniae*	55.5
salictariae	40.7	*saliciflori*	57.5
bruneri	41.7	*imitatrix*	58.0
neonanae	42.0	*nubeculae*	58.0
andrenoides	44.4	*cressoni*	59.5
hartfordensis	45.0	*moestae*	61.0
nasoni	45.0	*diabola*	62.0
oklahomae	46.5	*mandibularis*	62.0
erigeniae	47.6	*krygeri*	62.6
bipunctatae	48.8	*advarians*	64.0
medionitans	49.0	*californica*	64.0
sparsipilosae	50.0	*grandior*	65.0
subcandidae	50.0	*dunningi*	72.0
sinuatus	50.2	*vicinae*	73.8
vierecki	50.7	*crawfordi*	74.0
nudae	52.7	*cornii*	76.0
swenki	53.0	*solidulae*	79.2
hippotes	54.3	*pilipedis*	80.5
multiplicatae	54.5	*graenicheri*	81.0
bisalicidis	55.0		

Family Stylopidae arranged according to proportionate measurements.

Breadth of head in proportion to breadth of spiracles.	Breadth at base of mandibles in proportion to breadth at spiracles.	Breadth at base of cephalothorax in proportion to breadth at spiracles.	Length from spiracles to apex in proportion to breadth at spiracles.	Length of cephalothorax in proportion to breadth at spiracles.
nubeculae 0.51	*grandior* 0.31	*subcandidae* 0.54	*nubeculae* 0.58	*nubeculae* 0.87
graenicheri .53	*graenicheri* .33	*crawfordi* .65	*mandibularis* .59	*grandior* .88
cressoni .53	*mandibularis* .33	*bruneri* .66	*grandior* .62	*graenicheri* .92
claytoniae .54	*imitatrix* .34	*swenki* .66	*subcandidae* .62	*crawfordi* .94
cornii .54	*pilipedis* .34	*nubeculae* .67	*imitatrix* .62	*mandibularis* .96
nasoni .55	*crawfordi* .35	*imitatrix* .68	*claytoniae* .63	*subcandidae* .97
crawfordi .56	*californica* .35	*claytoniae* .68	*graenicheri* .63	*sinuatus* .97
grandior .56	*cressoni* .35	*vierecki* .68	*crawfordi* .63	*vierecki* .99
advarians .56	*nubeculae* .36	*graenicheri* .69	*sparsipilosae* .64	*imitatrix* 1.00
diabola .56	*claytoniae* .36	*cornii* .69	*nasoni* .64	*claytoniae* 1.00
bruneri .57	*nudae* .36	*solidulae* .69	*neonanae* .64	*nudae* 1.00
solidulae .57	*oklahomae* .36	*oklahomae* .70	*multiplicatae* .64	*sparsipilosae* 1.00
imitatrix .58	*bisalicidis* .36	*dunningi* .70	*hippotes* .64	*multiplicatae* 1.00
multiplicatae .58	*cornii* .37	*neonanae* .71	*nudae* .65	*bisalicidis* 1.00
krygeri .58	*diabola* .37	*polemonii* .72	*medionitans* .65	*advarians* 1.00
nudae .59	*polemonii* .37	*grandior* .73	*californica* .66	*swenki* 1.00
vicinae .59	*advarians* .37	*andrenoides* .73	*diabola* .67	*krygeri* 1.01
sinuatus .59	*krygeri* .37	*vicinae* .73	*vierecki* .67	*moestae* 1.03
oklahomae .59	*vierecki* .38	*nudae* .74	*cressoni* .67	*cornii* 1.03
polemonii .60	*sparsipilosae* .38	*pilipedis* .74	*pilipedis* .68	*californica* 1.03
salictariae .60	*vicinae* .38	*krygeri* .74	*salictariae* .68	*pilipedis* 1.03
bisalicidis .60	*erigeniae* .39	*medionitans* .75	*bisalicidis* .69	*vicinae* 1.03
hartfordensis .60	*moestae* .39	*erigeniae* .75	*polemonii* .69	*hippotes* 1.03
medionitans .61	*sinuatus* .40	*californica* .76	*erigeniae* .70	*diabola* 1.04
mandibularis .61	*neonanae* .40	*sinuatus* .77	*sinuatus* .70	*cressoni* 1.04
neonanae .61	*multiplicatae* .40	*diabola* .77	*oklahomae* .70	*neonanae* 1.04
californica .61	*medionitans* .40	*nasoni* .77	*cornii* .71	*andrenoides* 1.04
erigeniae .61	*hippotes* .40	*bisalicidis* .78	*solidulae* .71	*bipunctatae* 1.04
bipunctatae .61	*saliciflori* .40	*hippotes* .79	*vicinae* .71	*nasoni* 1.06
subcandidae .62	*dunningi* .40	*bipunctatae* .79	*advarians* .71	*hartfordensis* 1.06
moestae .62	*bruneri* .41	*mandibularis* .80	*andrenoides* .71	*salictariae* 1.06
dunningi .62	*solidulae* .41	*sparsipilosae* .80	*bipunctatae* .71	*bruneri* 1.07
sparsipilosae .62	*swenki* .41	*salictariae* .80	*hartfordensis* .71	*saliciflori* 1.07
andrenoides .62	*andrenoides* .41	*moestae* .81	*krygeri* .72	*solidulae* 1.08
vierecki .64	*bipunctatae* .41	*multiplicatae* .82	*bruneri* .72	*medionitans* 1.08
hippotes .64	*subcandidae* .42	*cressoni* .83	*swenki* .75	*erigeniae* 1.08
swenki .66	*nasoni* .42	*saliciflori* .83	*dunningi* .75	*oklahomae* 1.09
saliciflori .67	*salictariae* .42	*hartfordensis* .86	*saliciflori* .76	*polemonii* 1.10
pilipedis .67	*hartfordensis* .44	*advarians* .87	*moestae* .80	*dunningi* 1.11

11. Genus STYLOPS Kirby (1802).

The genus is hereby limited in the strict sense to those species in which the scutum is completely divided into two lateral pieces by the praescutum and scutellum. Typically it is also characterized by the scutellum being rather broadly rounded in front, not pedunculate.

The illustrations published by various authors, especially F. Smith,[1] show the general characters of the genus. On the strength of these *trimmerana* Smith is to be separated from *aterrima* Newport and placed in the genus *Neostylops*.

The genus in the strictest sense is now composed of the following species:

1. *melittae* Kirby, 1802 (type of genus); Europe; parasite of *Andrena nigroaenea* Kirby.
2. *kirbii* Leach, 1817; England; host unknown.
3. *dalii* Curtis, 1828; England; parasite of *Andrena labialis* Kirby.
4. *childreni* Gray, 1832; Nova Scotia; parasite of *Andrena victima* Smith.
5. *spencii* Pickering, 1835; Europe; parasite of *Andrena tibialis*, Kirby.
6. *aterrima* Newport, 1847; England; parasite of *Andrena trimmerana*, Kirby.
7. *dominiquei* Pierce, 1909; France; parasite of *Andrena flessae*, Panzer.
8. *championi* Pierce, new species; England; host unknown.

It probably also contains:

9. *thwaitei* Saunders, 1872; Europe; parasite of *Andrena afzeliella* Kirby.
10. *nassonowi* Pierce, 1909; Europe; parasite of *Andrena carbonaria* Linnaeus.
11. *ventricosae* Pierce, 1909; Hungary; parasite of *Andrena ventricosa* Dours.

As full descriptions of most of these species occur in Bulletin 66 no further mention will be made unless new notes require it.

2. STYLOPS KIRBII Leach, 1817.

Stylops kirbii LEACH, Zool. Misc., vol. 3, p. 135, pl. 149.

The illustration of *Stylops kirbyi* Leach by the author proves that it differs from any of the other English species, by the frontal prominence, the shape of the maxillae, and the antennae. Unfortunately the methathoracic structure is very indistinctly drawn, but judging from the shading the species must remain in typical *Stylops*.

[1] Trans. Ent. Soc. Lond., vol. 4, n s., 1856, pp. 1–4, pl. 24.

Dale (1841) records collecting on April 28, 1840, at Glanville's Wootten, England, a male on an Andrena containing females.

3. STYLOPS DALII Curtis.

Erratum: Gen. Insect., p. 16, line 38, read "pl. 226" for "p. 226."

5. STYLOPS SPENCII Pickering.

Erratum: Gen. Insect., p. 17, line 15, read "p. 168" for "p. 68."

8. STYLOPS CHAMPIONI, new species.

Plate 70, figs. 5, 6.

Described from a type male collected at Woking, Surrey, England, April 24, 1900, by G. C. Champion, and two paratype males collected April 5, 1912, and April 23, 1912, at Woking by H. G. Champion.

Length 3.5 mm. Velvety black, with appendages and wing veins piceous black, tarsal pads creamy yellow, ninth abdominal segment and oedeagus, yellowish, tenth segment black. Wings milky.

Eyes stalked with many ommatidia, very narrowly separated. Head triangularly produced. Antennae six-jointed; first joint longer and broader than second, which is ring like; third, ring like with long, broad, flattened flabellum, reaching about to middle of sixth; fourth, broad, flattened, as long as the next two together, which are subequal. Mandibles small, transparent yellowish, acute, ensiform, barely as long as the first joint of the maxillae. Maxillae two-jointed, the first longer than the second, broad, flabellate, longitudinally curved, with the depression beneath; first joint longer than second, the two equalling the third and fourth antennal joints. Head with small circular emargination behind.

Prothorax and mesothorax simple. Metathorax with keystone shaped praescutum, scutum two-lobed, separated by scutellum, which is narrowly pedunculate in front. Scuti carinate from wings almost to scutellum, thus indicating partial separation of parascutellum. Postlumbium black subchitinous, bisinuate at base, elongate rounded behind, as broad as long. Postscutellum longer than anterior portions of metathorax. Concave for reception of abdomen.

Wing venation consists of the basal costa, strong marginal subcosta; the approximate radius with the area between darkened, a short detached vein arising near the apex of radius; the usual medius with a faint detached vein in front of it and a short approximate detached vein behind it near apex; cubitus and three anal, the last rather short. A strong fold occurs between medius and cubitus.

The hypoepimeron (femoralium) practically incloses the posterior coxae.

The color of the anal regions is unusual.

The elytra have a strong marginal vein and at base have a small rounded flap.

Type.—Cat. No. 21438, U.S.N.M.

The remaining species are to be retained in *Stylops* until the male characters are known.

UNPLACED AS TO GROUP.

12. *asteridis* Pierce, 1911; Illinois; parasite of *Andrena asteris* Robertson.

GROUP 1.

13. *bipunctatae* Pierce, 1909; Indiana, Nebraska, Wisconsin, parasite of *Andrena bipunctata* Cresson.
14. *moestae* Pierce, new species; Washington; parasite of *Andrena moesta* Smith.

GROUP 2.

15. *mandibularis* Pierce, 1911; Illinois; parasite of *Andrena mandibularis* Robertson.

GROUP 3.

16. *nubeculae* Pierce, 1909; Colorado; parasite of *Andrena nubecula* Smith.

GROUP 4.

17. *subcandidae* Pierce, 1909; Southern California; parasite of *Andrena subcandida* Viereck.

GROUP 5.

18. *krygeri* Pierce, new species; Denmark; parasite of *Andrena*, species.

GROUP 6.

19. *multiplicatae* Pierce, 1909; Wisconsin; parasite of *Andrena multiplicata* Cockerell.
20. *advarians* Pierce, 1909; British Columbia; parasite of *Andrena advarians* Viereck.
21. *bisalicidis* Pierce, new species; Alabama; parasite of *Andrena bisalicis* Viereck.
22. *sparsipilosae* Pierce, 1909; Maine; parasite of *Andrena sparsipilosa* Viereck.

GROUP 7.

23. *erigeniae* Pierce, new species; Maryland, Illinois; parasite of *Andrena erigeniae* Robertson.

GROUP 8.

24. *hippotes* Pierce, 1909; Ohio; parasite of *Andrena hippotes* Robertson.
25. *nasoni* Pierce, 1909; Pennsylvania; parasite of *Andrena nasoni* Robertson.

GROUP 9.

26. *swenki* Pierce, 1909; Nebraska, Pennsylvania; parasite of *Andrena solidaginis* Robertson.

GROUP 10.

27*a*. *claytoniae*, var. *claytoniae* Pierce, 1909; Georgia, Illinois; parasite of *Andrena imitatrix* Cresson (*claytoniae* Robertson).

b. var. *imitatrix* Pierce, 1909; Texas; parasite of *Andrena imitatrix* Cresson.

c. var. *vierecki* Pierce, 1909; Texas; parasite of *Andrena imitatrix* Cresson (*texana profunda* Viereck).

GROUP 11.

28. *bruneri* Pierce, 1909; Nebraska, Illinois; parasite of *Andrena illinoiensis* Robertson.
29. *oklahomae* Pierce, 1909; Oklahoma; parasite of *Andrena falvoclypeata miserabilis* Cresson.
30. *salictariae* Pierce, new species; Illinois; parasite of *Andrena salictaria* Robertson.
31. *andrenoides* Pierce, 1911; Illinois; parasite of *Andrena andrenoides* Cresson.
32. *medionitans* Pierce, new species; Colorado; parasite of *Andrena medionitans* Cockerell.

GROUP 12.

33. *sinuatus* Pierce, new species; Illinois; parasite of *Andrena mandibularis* Robertson.
34. *grandior* Pierce, new species; Montana; parasite of *Andrena grandior multiplicatiformis* Viereck.
35. *nudae* Pierce, 1911; Illinois; parasite of *Andrena nuda* Robertson.
36. *cornii* Pierce, 1909; Wisconsin; parasite of *Andrena commoda* Smith.
37. *californica* Pierce, 1909; southern California; parasite of *Andrena subtilis* Smith.
38. *vicinae* Pierce, 1909; New Hampshire, Connecticut, Canada, Massachusetts, Colorado; parasite of *Andrena vicina* Smith.

GROUP 13.

39. *salicifloris* Pierce, 1909; Washington; parasite of *Andrena salicifloris* Cockerell.

GROUP 14.

40. *graenicheri* Pierce, 1909; Wisconsin; parasite of *Andrena nivalis* Smith.

GROUP 15.

41. *cressoni* Pierce, 1909; Maine; parasite of *Andrena cressoni* Robertson.
42. *diabola* Pierce, new species; North Dakota; parasite of *Andrena bisalicis* Viereck, var.

GROUP 16.

43. *hartfordensis* Pierce, 1909; Georgia, parasite of *Andrena hartfordensis* Cockerell.
44. *neonanae* Pierce, new species; Georgia; parasite of *Andrena neonana* Viereck.

12. STYLOPS ASTERIDIS Pierce.

Table of measurements.

Specimen	1	2	3	4	5	6
Type, Carlinsville, Illinois	(?)	41	26	(?)	41	(?)

GROUP 1.

13. STYLOPS BIPUNCTATAE Pierce.

It has two toothed mandibles and spiracles distant from margin.

Table of measurements of female.

Specimen	1	2	3	4	5	6
1. Type, Indiana	50	31	22	41	36	53
2. Nebraska	50.5	31	20	38	34	50
3. Polk Co., Wisconsin	46	28	19	38	34	50
Average	48.8	30	20	39	35	51

Taking measure 1 as unit, the following relative lengths of the other measurements are obtained:

Specimen	1	2	3	4	5	6	Index total.
Relative length compared to width at spiracles:							
1	1.00	0.62	0.44	0.82	0.72	1.06	4.66
2	1.00	.61	.39	.75	.67	.99	4.41
3	1.00	.60	.41	.82	.73	1.09	4.65
	1.00	.61	.41	.79	.71	1.04	4.56

The range of differences is very small. A numerical index may be obtained by adding the six relative measurements together. This gives totals ranging from 4.41 to 4.66 and averaging 4.56, which we may call the species index.

14. STYLOPS MOESTAE, new species.

Described from two females extracted from a specimen of *Andrena moesta* Smith, determined by H. L. Viereck, collected at Govan, Washington, March 29, 1911, by J. A. Hyslop.

Female.—Cephalothorax broad; yellowish brown with dark reddish brown basal band; spiracles not reaching lateral margin; mandibles broad, subquadrate with apical tooth. Length of cephalothorax, 1 mm.; breadth, 0.8 mm.

Table of measurements.

Specimen	1	2	3	4	5	6	Index total.
1. Type, Govan, Washington	63	38	24	50	49	61	.....
Paratype, Govan, Washington	59	38	24	50	49	64.5	.....
Average	61	38	24	50	49	62.7	.....
Relative length compared to breadth at spiracles:							
1	1.00	0.60	0.38	0.79	0.77	0.97	4.51
2	1.00	.61	.40	.84	.83	1.09	4.80
Average	1.00	.62	.39	.81	.80	1.03	4.65

Type.—Cat. No. 21439, U.S.N.M.

GROUP 2.

15. STYLOPS MANDIBULARIS Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Carlinville, Illinois	62	38	21	50	37	60	.....
Relative length compared to width at spiracles	1.00	0.61	0.33	0.80	0.59	0.96	4.29

GROUP 3.

16. STYLOPS NUBECULAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type	58	30	21	39	33	51	.....
Relative length compared to width at spiracles	1.00	0.51	0.36	0.67	0.58	0.87	3.99

GROUP 4.

17. STYLOPS SUBCANDIDAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
1. Type, Southern California	50	31	21	36	30	47	.....
2. Paratype, Southern California	50	31	21	38	32	50	.....
Average	50	31	21	37	31	48.5	.....
Relative length compared to width at spiracles:							
1	1.00	0.62	0.42	0.52	0.60	0.90	4.10
2	1.00	.62	.42	.56	.64	1.00	4.24
Average	1.00	.62	.42	.54	.62	.97	4.17

GROUP 5.

17. STYLOPS KRYGERI, new species.

Described from three females, extracted from two specimens of an Andrena, originally determined as *Halictus zonulus* Smith, collected at Fejo, Denmark, November 6, 1915, and sent the author by Mr. J. P. Kryger.

Female.—Cephalothorax reddish brown with large basal dark brown area extending almost to the middle; rather elongate, not strongly narrowed in front; constricted at base; spiracles lateral, hardly prominent; mandibles rounded with the tooth on the inner side surpassed by the apex.

Length of cephalothorax, 1.1 mm.; breadth, 1 mm.

Table of measurements.

Specimen	1	2	3	4	5	6	Index total.
1. Type	61.5	37	27.5	45	47	65	.....
2. Paratype	62.0	37	23.0	.....	45	.....	.....
3. Paratype	64.5	37	26.0	49	44	63	.....
Average	62.6	37	25.5	47	45.3	64	.....
Relative length compared to breadth at spiracles:							
1	1.00	0.60	0.44	0.73	0.76	1.05	4.58
2	1.00	.59	.37	.....	.72	.....	.....
3	1.00	.57	.40	.76	.68	.97	4.38
Average	1.00	.586	.40	.745	.72	1.01	4.46

Types.—Cat. No. 21440, U.S.N.M.

GROUP 6.

19. STYLOPS MULTIPLICATAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Milwaukee, Wisconsin, Apr. 9, 1904	54.5	32	22	45	35	55	.....
Relative length compared with width at spiracle	1.00	0.58	0.40	0.82	0.64	1.00	4.44

20. STYLOPS ADVARIANS Pierce.

Plate 71, figs. 11, 12.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Vancouver, British Columbia	64	36	24	56	46	64	.....
Relative lenght compared to width at spiracles	1.00	0.56	0.37	0.87	0.71	1.00	4.51

Illustrations are presented of the female cephalothorax and the right mandible.

21. STYLOPS BISALICIDIS, new species.

Described from one female extracted from an *Andrena bisalicis* Viereck (determined by Viereck) from Alabama collected by C. F. Baker, No. 2223.

Female.—Cephalothorax reddish brown with darker basal band; broad at base, narrowed at apex; mandibles subquadrate, with single apical tooth; spiracles lateral, but not prominent. Length of cephalothorax, 0.9 mm.; breadth, 0.9 mm.

Table of measurements.

Specimen	1	2	3	4	5	6	Index total.
Type	55	33	21	43	38	55	.....
Relative length compared to breadth at spiracles	1.00	0.60	0.36	0.78	0.69	1.00	4.43

Type.—Cat. No. 21441, U.S.N.M.

22. STYLOPS SPARSIPILOSAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total
Type, Waldoboro, Maine	50	31	19	40	32	50	.....
Relative length compared to width at spiracles	1.00	0.62	0.38	0.80	0.64	1.00	4.44

GROUP 7.

23. STYLOPS ERIGENIAE, new species.

Described from two females from a female *Andrena erigeniae* Robertson, collected on *Erythronium americanum* at Plummers Island. Maryland, March 29, 1915, by J. C. Crawford; the type in the collection of the United States National Museum and the paratype in the collection of the author. Another paratype specimen in the museum collection was taken from an *Andrena erigeniae* collected at Carlinville, Illinois, April 1, by Charles Robertson.

Female.—Cephalothorax yellowish brown, with broad basal dark reddish brown band. Length of cephalothorax of type 0.8 mm.; breadth, 1 mm. Mandibles with one sharp curved tooth. Cephalothorax broadest behind spiracles which are laterally prominent.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
1. Carlinville, Illinois	51	31	19	40	35	58	.....
2. Plummers Island, Maryland	49	32	20	37	38	58	.....
3. Type, Plummers Island, Maryland	50	32	21	39	32	51	.....
4. Plummers Island, Maryland	42.5	24	16	30.5	29	45	.....
5. Plummers Island, Maryland	45.5	28	18	(?)	33	47	.....
Average	47.6	29.4	18.8	36.6	33.4	51.8	.....
Relative length compared to width at spiracles:							
1	1.00	0.60	0.36	0.78	0.68	1.13	4.55
2	1.00	.65	.40	.75	.77	1.18	4.75
3	1.00	.64	.42	.78	.64	1.02	4.50
4	1.00	.56	.37	.71	.68	1.05	4.37
5	1.00	.61	.39	(?)	.72	1.03	(?)
Average	1.00	.61	.39	.75	.70	1.08	4.53

Specimen No. 4 is quite different from the other specimens in its proportions and size. In fact it is possibly a distinct species.

Type.—Cat. No. 21442, U.S.N.M.

GROUP 8.

24. STYLOPS HIPPOTES Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Columbus, Ohio	54.3	35	22	43	35	56	.....
Relative length compared to width at spiracles	1.00	0.64	0.40	0.79	0.64	1.03	4.50

25. STYLOPS NASONI Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type	45	25	19	35	29	48	.....
Relative length compared to width at spiracles	1.00	0.55	0.42	0.77	0.64	1.06	4.44

GROUP 9.

26. STYLOPS SWENKI Pierce.

Plate 71, figs. 1, 2, 8, 9, 10.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
4. Paratype, Lincoln, Nebraska	53	35	22	35	40	55	.....
Relative length compared to width at spiracles	1.00	0.66	0.41	0.66	0.75	1.03	4.51

An illustration of the female cephalothorax is presented.

GROUP 10.

27a. STYLOPS CLAYTONIAE, var. CLAYTONIAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Thomasville, Georgia	55.5	30.5	20	38	35	59	.....
Relative length compared to width at spiracles	1.00	0.54	0.36	0.68	0.63	1.06	4.27

27b. STYLOPS CLAYTONIAE, var. IMITATRIX Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Round Mountain, Texas	58	34	20	40	36	58	.....
Relative length compared to width at spiracles	1.00	0.58	0.34	0.68	0.62	1.00	4.22

27c. STYLOPS CLAYTONIAE, var. VIERECKI Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
1. Type, Fedor, Texas	49	31.7	19.5	35	33	51	.....
2. Cotype, Fedor, Texas	51	34	20	35	37	52	.....
3. Cotype, Fedor, Texas	51.5	32	19	35	33	48	.....
Average	50.7	32.5	19.5	35	34.5	50	.....
Relative length compared to width at spiracles:							
1	1.00	0.64	0.39	0.71	0.67	1.04	4.45
2	1.00	.66	.39	.68	.72	1.01	4.46
3	1.00	.62	.36	.67	.64	.93	4.22
Average	1.00	.64	.38	.68	.67	.99	4.37

GROUP 11.

28. STYLOPS BRUNERI Pierce.

Plate 71, figs. 1, 2, 8, 9, 10.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
1. Type, Sioux County, Nebraska	45	25.5	19	30	33	48.5	.....
2. Lincoln, Nebraska	38.5	23	16.5	(?)	28	41	.....
Average	41.7	24.2	17.7	.....	32.5	44.7	.....
Relative length compared to width to width at spiracles:							
1	1.00	.56	.42	.66	.73	1.07	4.44
2	1.00	.59	.40	(?)	.72	1.07	(?)
Average	1.00	.57	.41	.66	.72	1.07	4.43

The range of differences is very small. A numerical index may be obtained by adding the six relative measurements together. This gives an average index of 4.43. Illustrations are given of the female cephalothorax and mandibles.

29. STYLOPS OKLAHOMAE Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Ardmore, Oklahoma.	46.5	27.5	17	33	33	51	.....
Relative length compared to width at spiracles.	1.00	0.59	0.36	0.70	0.70	1.0	4.44

30. STYLOPS SALICTARIAE, new species.

Described from seven female specimens from *Andrena salictaria* Robertson, collected by Charles Robertson at Carlinville, Illinois. Specimens in collection United States National Museum.

Female.—Cephalothorax yellowish brown, with broad basal dark reddish brown band. Length of cephalothorax of type 1.8 mm.; breadth 0.7 mm. Mandibles broad, bluntly two toothed. Spiracles laterally slightly prominent.

Table of measurements of female.

Specimen	1	2	3	4	5	6
Carlinville, Illinois:						
1 (type)	41.2	24	17	35	27	44
2	43.3	26.5	17.5	35	29.5	45
3	42	26.5	18	34	30	45
4	38.7	23	18	33	28	45
5	45	27	18	34	29	44
6 (immature)	40	24	16	(?)	26	(?)
7 (immature)	35	23	16	(?)	25	(?)
Average	40.7	24.8	17.2	34.2	27.7	44.6

Taking measurement 1 as unit, the following relative lengths of the other measurements are obtained:

Specimen	1	2	3	4	5	6	Index total.
Relative length compared to width at spiracles:							
1 (type)	1.00	0.58	0.41	0.84	0.65	1.06	4.54
2	1.00	.60	.40	.80	.68	1.04	4.52
3	1.00	.63	.42	.80	.71	1.07	4.63
4	1.00	.59	.46	.85	.72	1.16	4.78
5	1.00	.60	.40	.75	.64	.97	4.36
6	1.00	.60	.40	(?)	.65	(?)	(?)
7	1.00	.65	.45	(?)	.71	(?)	(?)
Average	1.00	.60	.42	.80	.68	1.06	4.56

Type.—Cat. No. 21443, U.S.N.M.

31. STYLOPS ANDRENOIDES Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Illinois:							
1 (type)	51	29	18.5	(?)	32	46	.....
2	37	25	17	29	25	38	.....
3	44	28	18	30	35	48	.....
4	40.2	26	18	30	31	43	.....
5	50	30	21	38	35	52	.....
6	45	27	21	34	32.5	46	.....
7	44	28	17	30	32	48	.....
Average	44.4	27.5	18.6	31.8	31.7	45.8	.....
Relative length compared to width at spiracles:							
1 (type)	1.00	0.56	0.36	(?)	0.62	0.90	(?)
2	1.00	.67	.40	0.78	.67	1.02	4.54
3	1.00	.63	.40	.68	.79	1.09	4.59
4	1.00	.64	.44	.74	.77	1.07	4.66
5	1.00	.60	.42	.76	.70	1.04	4.52
6	1.00	.60	.46	.75	.72	1.06	4.59
7	1.00	.63	.38	.68	.72	1.09	4.50
Average	1	.62	.41	.73	.71	1.04	4.51

The material may possibly contain two or more or distinct species, but it is more likely that the differences are accounted for by specific variation.

32. STYLOPS MEDIONITANS, new species.

Described from one female extracted from an *Andrena medionitans* Cockerell, determined by Cockerell, collected at Florissant, Colorado, June 24, on *Cerasus melanocarpa*, by T. D. A. Cockerell.

Female.—Cephalothorax yellowish brown with dark basal band; rather broad and rounded; strongly constricted at base; spiracles marginal, not prominent; mandibles dentate at apex, strongly rounded at outer apical angle and angulate on side.

Length of cephalothorax, 0.8 mm.; breadth, 0.8 mm.

Table of measurements.

Specimen	1	2	3	4	5	6	Index total.
Type	49	30	20	37	32	53	.....
Relative length compared to breadth at spiracles	1.00	0.61	0.40	0.75	0.65	1.08	4.49

Type.—Cat. No. 21444, U.S.N.M.

GROUP 12.

33. STYLOPS SINUATUS, new species.

Described from two specimens from *Andrena mandibularis* Robertson, collected April 10, at Carlinville, Illinois, by Charles Robertson, but differing from *Stylops mandibularis* in the same host by numerous characters.

Female.—Cephalothorax yellowish brown; with broad basal reddish brown band. Length of cephalothorax, 0.7 mm.; breadth, 0.7 mm. Mandibles subquadrate, rounded, with small outward pointing tooth at apex. Spiracles laterally prominent. Lateral margin strongly sinuous, with two constrictions between spiracles and base of head, which is also constricted and suddenly enlarged just beyond, then again strongly narrowed some distance behind the base of the mandibles.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type Carlinville, Illinois	51.5	29.7	21	39	37	52	.....
2. Paratype	49	30	20	39	34	47	.....
Average	50.2	29.8	20.5	39	35.5	49.9	.....
Relative length compared to width at spiracles:							
1	1.00	0.57	0.40	0.75	0.71	1.00	4.43
2	1.00	.61	.40	.79	.69	.95	4.44
Average	1.00	.59	.40	.77	.70	.97	4.43

Type.—Cat. No. 21445, U.S.N.M.

34. STYLOPS GRANDIOR, new species.

Described from two females extracted from a specimen of *Andrena grandior multiplicatiformis* Viereck, determined by Viereck, collected June 21, 1904, at Big Fork, Montana.

Female.—Cephalothorax yellowish brown with dark-brown basal band; very broad at base, strongly narrowed toward apex; sides subparallel for short distance behind spiracles and then strongly constricted; spiracles very prominent laterally; mandibles subquadrate with apical tooth pointed outward. Length of cephalothorax, 0.9; breadth, 1 mm.

Table of measurements.

Specimens	1	2	3	4	5	6	Index total.
1. Type	68	37	22	45	44	63	.....
2. Paratype	62	37	19	50	37	53	.....
Average	65	37	20.5	47.5	40.5	58	.....
Relative length compared to breadth at spiracles:							
1	1.00	0.54	0.32	0.66	0.64	0.92	4.08
2	1.00	.59	.30	.80	.59	.85	4.13
Average	1.00	.56	.31	.73	.62	.88	4.10

Type.—Cat. No. 21446, U.S.N.M.

35. STYLOPS NUDAE Pierce.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, Carlinville, Illinois	54	32	19	40	34	54	.....
2. Paratype	51.3	31	18.5	38	33	52	.....
Average	52.6	31.5	18.7	39	33.5	53	.....
Relative length compared to width at spiracles:							
1	1.00	0.59	0.35	0.74	0.63	1.00	4.31
2	1.00	.60	.36	.74	.66	1.01	4.37
Average	1.00	.59	.36	.74	.65	1.00	4.34

Length of triungulinid, 0.2 mm.

36. STYLOPS CORNII Pierce.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, Milwaukee, Wisconsin	72	38	27	50	53	76	.....
2. Paratype, Wisconsin	80	45	30	56	56	81	.....
Average	76	41.5	28.5	53	54.5	78.5	.....
Relative length compared to width at spiracles:							
1	1.00	0.52	0.37	0.69	0.73	1.05	4.36
2	1.00	.56	.37	.70	.70	1.01	4.34
Average	1.00	.54	.37	.69	.71	1.03	4.35

37. STYLOPS CALIFORNICA Pierce.

Plate 71, figs. 5–7.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, Southern California	64	40.5	22.5	46	44	66	.....
2. Paratype, Southern California	64	39	22.5	52	41	66	.....
Average	64	39.7	22.5	49	42.5	66	.....
Relative length compared to width at spiracles:							
1	1.00	0.63	0.35	0.71	0.68	1.03	4.40
2	1.00	.60	.35	.81	.64	1.03	4.43
Average	1.00	.61	.35	.76	.66	1.03	4.41

Illustrations are presented of the female cephalothorax and mandible and of a triungulinid.

38. STYLOPS VICINAE Pierce.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, New Hampshire	71	44	28	52	50	73	.....
2. Paratype, New Hampshire	69	44.5	29	53	51	73	.....
3. Paratype, Canada	75	43	26	57	54.5	75	.....
4. Paratype, Canada	77	48	32	54	55	80	.....
5. Salina, Colorado	75	44.5	28	57	56	80	.....
6. Boulder, Colorado	75	44	29	55.5	54	77	.....
7. Plummer's Island, Maryland	72.5	41	28	50	52	73	.....
8. Plummer's Island, Maryland	74	44	28.5	52.5	54	76	.....
9. Cabin John Bridge, Maryland	74	45	27	53	54.5	81	.....
10. Lahaway, New Jersey	76	47	30	57	53	80	.....
11. Plummer's Island, Maryland	72	45	29	51	54	80	.....
Average	73.6	44.5	28.5	53.7	53.4	77.0	.....
Relative length compared to width at spiracles:							
1	1.00	0.61	0.39	0.73	0.70	1.04	4.47
2	1.00	.64	.42	.76	.73	1.05	4.60
3	1.00	.57	.34	.76	.72	1.00	4.39
4	1.00	.62	.41	.70	.71	1.03	4.47
5	1.00	.59	.37	.76	.74	1.06	4.52
6	1.00	.58	.38	.74	.72	1.02	4.44
7	1.00	.56	.38	.68	.71	1.00	4.53
8	1.00	.59	.38	.70	.72	1.02	4.41
9	1.00	.60	.36	.71	.73	1.09	4.49
10	1.00	.61	.39	.75	.69	1.05	4.49
11	1.00	.62	.40	.70	.75	1.11	4.58
Average	1.00	.60	.38	.72	.72	1.04	4.46

GROUP 13.

39. STYLOPS SALICIFLORIS Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type	57.5	59	23	48	44	62	.....
Relative length compared to width at spiracles	1.00	0.67	0.40	0.83	0.76	1.07	4.73

GROUP 14.

40. STYLOPS GRAENICHERI Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Milwaukee, Wisconsin	81	43	27	56	51	75	.....
Relative length compared to width at spiracles	1.00	0.53	0.33	0.69	0.63	0.92	4.10

GROUP 15.

41. STYLOPS CRESSONI Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Waldoboro, Maine	59.5	32	21	50	40	62	.....
Relative length compared to width at spiracles	1.00	0.53	0.35	0.83	0.67	1.04	4.42

42. STYLOPS DIABOLA, new species.

Described from one female extracted from an *Andrena bisalicis* Viereck, var. (determined by Viereck) from Devils Lake, North Dakota, collected May 15, 1916, on *Amelanchier*.

Female.—Cephalothorax yellow with a very dark brown basal band; spiracles very prominent; mandibles rounded, with subapical tooth on inner margin and an angle on outer margin. Length, 1 mm.; breadth, 1 mm.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type	62	35	23	48	42	65	.....
Relative length compared to breadth at spiracles	1.00	0.56	0.37	0.77	0.67	1.04	4.41

Type.—Cat. No. 21447, U.S.N.M.

GROUP 16.

43. STYLOPS HARTFORDENSIS Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Thomasville, Georgia	45	27	20	39	32	48	.....
Relative length compared to width at spiracles	1.00	0.60	0.44	0.86	0.71	1.06	4.67

44. STYLOPS NEONANAE, new species.

Described from one female extracted from a specimen of *Andrena neonana* Viereck, paratype, collected in Georgia, and the property of the Philadelphia Entomological Society.

Female.—Cephalothorax, yellowish brown with dark-brown basal band; broad, rounded; spiracles prominent; mandibles with apical tooth and with lateral angle almost a tooth. Length of cephalothorax, 0.7 mm.; breadth, 0.7 mm.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Georgia	42	26	17	30	27	44	.....
Relative length compared to breadth at spiracles	1.00	0.61	0.40	0.71	0.64	1.04	4.40

Type.—In the Philadelphia Academy of Sciences.

KATASTYLOPS, new subgenus.

I have separated off this subgenus because of the great difference between its type, *Stylops polemonii* Pierce, and the other species of

Stylops in female characters. It is the smallest known parasite of the genus *Andrena* and differs greatly in the proportions of the cephalothorax; although taken separately the various proportions range within the variations of typical *Stylops*. The mandibles are not dentate and the spiracles not prominent. It can not be separated as a genus until the male is known.

Species: 1. *polemonii* Pierce, 1909; Colorado; parasite on *Andrena polemonii* Robertson.

STYLOPS (KATASTYLOPS) POLEMONII Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Colorado	34.5	21	13	25	24	38	.....
Relative length compared to width at spiracles	1.00	0.60	0.37	0.72	0.67	1.10	4.48

PROSTYLOPS, new subgenus.

I have separated off this subgenus because of the great difference between its type, *Stylops pilipedis* Pierce, and the other species of *Stylops* in female characters. It is the largest known parasite of the genus *Andrena*, and differs greatly in the proportions of the cephalothorax from other *Stylops*. The mandibles are not dentate and the spiracles barely surpass the lateral margin. It can not be separated as a genus until the male is known.

Species: 1. *pilipedis* Pierce, 1911; China; parasite of *Andrena pilipes* Fabricius.

STYLOPS (PROSTYLOPS) PILIPEDIS Pierce.

Table of measurements of female.

Specimen	1	2	3	4	5	6	Index total.
Type, Pekin, China	80.5	54	28	60	55	83	.....
Relative length compared to width at spiracles	1.00	0.67	0.34	0.74	0.68	1.03	4.46

12. NEOSTYLOPS, new genus.

Type of the genus.—Neostylops crawfordi Pierce.

Male.—Methathoracic scutum connected between praescutum and scutellum.

Female.—Cephalothorax with marginal, but not prominent spiracles, and mandibles without teeth, or with but a single tooth (*solidulae*).

The genus probably includes several species still included in *Stylops sensu latiore*, because the males are unknown. The differences in the females recorded indicate that probably further subdivisions will become necessary.

It includes the following species:

1. *crawfordi* Pierce (Stylops), parasitic on *Andrena crawfordi* Viereck; Texas.

2. *trimmerana* Smith (Stylops), parasitic on *Andrena trimmerana* Kirby; England.

3. *solidulae* Pierce (Stylops), parasitic on *Andrena solidula* Viereck; Washington.

4. *shannoni* Pierce; host unknown; Maryland.

1. NEOSTYLOPS CRAWFORDI Pierce.

Plate 70, figs. 3, 4.

Stylops crawfordi PIERCE, 1909, U. S. Nat. Mus., Bull. 66, pp. 100–102.
Errata: Gen. Insect. Page 52, lines 16, 17, read "5" for "4." Page 16, line 36, add "Pl. 1, unnumbered figure."

Male.—The male has a very interesting mesothoracic spiracle located on the margin between the propleuron and mesopleuron and immediately at the base of the elytra. This spiracle has a very large oval opening and is of the annular type with a crenulate soft lip. It is impossible to see the form of the inner opening and of the closing apparatus. The figure given shows the position with relation to the elytron, which happens to be so folded as to obscure a considerable portion of the opening. It is bounded in front by the proepimeron, above by the mesopraescutum+scutum, and behind by intersegmental skin (pl. 70, fig. 3).

A drawing of the side view of the male (pl. 70, fig. 4) is also presented.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, Dallas, Texas	73	41	25	50	45	70	.....
2. Paratype, Dallas, Tex	75	43	28	47	50	70	.....
Average	74	42	26.5	48.5	47.5	70	.....
Relative length compared to width at spiracles:							
1	1.00	0.56	0.34	0.68	0.61	0.95	4.14
2	1.00	.57	.37	.62	.66	.93	4.15
Average	1.00	.56	.35	.65	.63	.94	4.14

2. NEOSTYLOPS TRIMMERANA Smith.

Stylops trimmerana SMITH, 1856, Trans. Ent. Soc. Lond., ser. 2*a*, vol. 4, p. 118, pl. 24, fig. 6.

Stylops aterrima (Newport) (*trimmerana* Smith) SAUNDERS, 1872, Trans. Ent. Soc. Lond., 1871, p. 29. [Not *aterrima* Newport.]

According to the drawings made by Smith, this species differs greatly from *aterrima* in thoracic characters and should be referred to this genus.

3. NEOSTYLOPS SOLIDULAE Pierce.

Table of measurements of female.

Specimens	1	2	3	4	5	6	Index total.
1. Type, Pullman, Washington	82	48	35	55	59	90	.....
2. Paratype, Washington	76.5	44	29	54	55.5	82	.....
Average	79.2	52	32	54.5	57.2	86	.....
Relative length compared to width at spiracles:							
1	1.00	0.58	0.42	0.67	0.71	1.09	4.47
2	1.00	.57	.39	.70	.72	1.07	4.45
Average	1.00	.57	.41	.69	.71	1.08	4.46

The male pupa has scutum united in front of scutellum.

4. NEOSTYLOPS SHANNONI, new species.

Plate 70, figs. 1, 2.

Described from one male collected on Plummers Island, Maryland, April 7, 1915, by R. C. Shannon.

Male.—Velvety black, pro- and mesothorax shining, eyes, antennae, femora, elytra, and wing veins piceous; tibiae, tarsi and last ventral segment lighter, straw colored.

Antennae with second joint minute; third short with flabellum surpassed by sixth; fourth longer; fifth shorter than sixth. Mandibles very slender, not reaching beyond basal third of second maxillary joint. Maxillae very large, lamellate, second joint longer than first and about equal to fourth antennal joint. Front flattened into an overhanging triangular ledge over the mouth parts.

The mesothoracic spiracle is located at the base of elytron. The prothorax and mesothorax are very small and each is divided by a transverse fold. The metathorax is very large; the praescutum keystone shape; the scutum broadly connected behind praescutum, but with a deep depression in front of the scutellum; scutellum broadly rounded in front; postlumbium very large, depressed and heavily chitinized, of the same color as the remainder of the thorax; postscutellum longitudinally depressed.

The elytron has a small anal lobe.

Type.—Cat. No. 21448, U.S.N.M.

12. Genus PARASTYLOPS Meijere (1908).

Parastylops Meijere, 1911.

1. *P. flagellatus* Meijere, host unknown; Java.

VII. Family HYLECTHRIDAE Pierce.

In all my publications the spelling of this family name and of the genus *Hylecthrus*, except when used in quoting bibliographic refer-

ences, should be changed from "Hylechthridae" and "Hylechthrus" to "Hylecthridae" and "Hylecthrus" to agree with the original spelling. The original description cites the Greek origin of the word, which should have properly been spelled Hylechthrus.

13. Genus HYLECTHRUS Saunders.

LIST OF SPECIES.

1. *H. rubi* Saunders; parasite of *Prosopis rubicola* Saunders; Epirus.

2. *H. quercus* Saunders; parasite of *Prosopis gibba* Saunders; Epirus.

3. *H. sieboldii* Saunders; parasite of *Prosopis variegata* Fabricius, Epirus.

1. HYLECTHRUS RUBI Saunders.

Errata: Gen. Insect., p. 18, line 23, add "Pl. 1, numbered figure."

VIII. Family XENIDAE Semenov.

Table of subfamilies.

1. Male metathoracic scutellum broadly truncate in front, not pedunculate; postlumbium more than half as long as wide. Parasites of Apoidea---- 2.
   Male metathoracic scutellum pedunculate anteriorly, postlumbium short and transverse; maxillae two-jointed; oedeagus inflated at basal angle, sharply angulate at apical third. Female with four median genital tubes entering brood canal---------- 3. XENINAE Pierce.
2. Male maxillae simple, two-jointed; oedeagus not conspicuously inflated at basal angle, sharply angulate at apical third. Female with five median genital tubes entering brood canal----------1. HALICTOXENINAE Pierce.
   Male maxillae three-jointed; oedeagus beginning as a slender tube, then greatly inflated, bent at right angles and produced as a very slender process---------- 2. CRAWFORDINAE Pierce.

1. Subfamily HALICTOXENINAE Pierce.

Table of genera.

Male maxillae with first joint longer than second; oedeagus strongly arcuate beneath at middle---------- 14. *Halictoxenos* Pierce.

Male maxillae with first joint shorter than second, oedeagus not strongly arcuate beneath at middle; wings with two detached branches of radius and two of medius, between radius and medius--- 15. *Apractelytra* Pierce.

14. Genus HALICTOXENOS Pierce.

Table of subgenera.

Female cephalothorax triangular, narrowly and roundingly truncate at apex, obviously constricted at base of head; breadth of cephalothorax at widest point 1.9 to 2.3 times as wide as breadth of head at base. Parasites of *Chloralictus*---------- 1. *Halictoxenos* Pierce.

Female cephalothorax less apparently triangular, broadly and evenly rounded to apex, with very slight sinuations at sides; breadth of cephalothorax at widest point 1.4 times as wide as breadth of head at base. Parasites of *Evylaeus*---------- 2. *Halictophilus* Pierce.

Female cephalothorax almost triangular, narrowly truncate at apex; head about one-third as wide as metathorax at spiracles. Parasites of *Halictus*. ---------- 3. *Halictostylops* Pierce.

Female cepthalothorax very broad at base, triangular, convexly truncate at apex, strongly constricted at base of head; breadth of cephalothorax at widest point 1.5 times as wide as breadth of head at base. Parasite of *Augochlora*---------- 4. *Augochlorophilus* Pierce.

LIST OF SPECIES.

1. *H.* (*Halictoxenos*) *crawfordi* Pierce; parasite of *Halictus* (*Chloralictus*) *bruneri* Crawford, Nebraska.
2. *H.* (*H.*) *graenicheri* Pierce; parasite of *H.* (*C.*) *albipennis* Robertson; Wisconsin.
3. *H.* (*H.*) *jonesi* Pierce; parasite of *H.* (*C.*) species; Texas, Louisiana.
4. *H.* (*H.*) *nymphaeari* Pierce; parasite of *H.* (*C.*) *nymphacarum* Robertson; Illinois.
5. *H.* (*H.*) *sparsi* Pierce; parasite of *H.* (*C.*) *sparus* Robertson; Oklahoma.
6. *H.* (*H.*) *versati* Pierce; parasite of *H.* (*C.*) *versatus* Robertson; Wisconsin.
7. *H.* (*H.*) *zephyri* Pierce; parasite of *H.* (*C.*) *zephyrus* Smith; Wisconsin.
8. *H.* (*Halictophilus*) *manilae* Pierce; parasite of *H.* (*Evylaeus*) *manilae* Ashmead; Philippines.
9. *H.* (*H.*) *robbii* Pierce; parasite of *H.* (*E.*) *robbii* Ashmead; Philippines.
10. *H.* (*Halictostylops*) *spencii* Nassonow; parasite of *Halictus minutus* Kirby; Europe.
11. *H.* (*Augochlorophilus*) *viridulae* Pierce; parasite of *Augochlora viridula* F. Smith; Illinois.

3. HALICTOXENOS JONESI Pierce.

Errata: Gen. Insect., p. 21, line 12, add "Pl. 3, unnumbered figure."

15. Genus APRACTELYTRA Pierce.

1. *A. schwarzi* Pierce; host unknown; District of Columbia.

1. APRACTELYTRA SCHWARZI Pierce.

Errata: Gen. Insect., p. 22, line 21, add "Pl. 2, unnumbered figure"; pl. 2, unnumbered figure, for "Aproctelytra" read "Apractelytra."

2. Subfamily CRAWFORDINAE Pierce.

16. Genus CRAWFORDIA Pierce.

1. *C. pulvinipes* Pierce; parasite of *Panurginus innuptus* Cockerell; Nebraska.
2. *C. cockerelli* Pierce; parasite of *Panurginus boylei* Cockerell; New Mexico.
3. *C. labrosi* Pierce; parasite of *Panurginus labrosus* Robertson; Illinois.
4. *C. rudbeckiae* Pierce; parasite of *Panurginus rudbeckiae* Robertson; Illinois.

5. *C. californica* Pierce; parasite of *Panurginus californicus* Cresson; Califronia.
6. *C. labrosiformidis* Pierce; parasite of *Panurginus labrosiformis* Robertson; Illinois.

1. CRAWFORDIA PULVINIPES Pierce.

Errata: Gen. Insect., p. 23, line 13, add "Pl. 2, unnumbered figure."

Subfamily XENINAE Pierce.

1. Anterior edges of scutellum convergent, not parallel; wings with eight primary veins from base ..... 2.
   Anterior edges of scutellum parallel or almost so ..... 3.
2. Parasites of Vespidae. Wings with radius sometimes indistinct, radius sometimes broken for a short distance, one detached vein between radius and medius ..... 1. *Xenini* Pierce.
   Parasites of Eumenidae. Wings with two detached veins between radius and medius ..... 2. *Pseudoxenini* Pierce.
3. Metathoracic postlumbium spindle-shaped, constricted at middle. Parasites of Larridae ..... 3. *Tachytixenini* Pierce.
   Metathoracic postlumbium not constricted at middle ..... 4.
4. Parasites of Sphecidae. Wings with two detached veins between radius and medius, and one between medius and cubitus. 4. *Ophthalmochlini* Pierce.
   Parasites of Bembecidae. Wings with two detached veins between radius and medius ..... 5. *Paraxenini* Pierce.

1. Tribe XENINI Pierce

1. Triungulinid with two apical stylets ..... 2.
   Triungulinid with four apical stylets. Parasites of Belonogaster. 19. *Belonogastechthrus* Pierce.
2. Parasites of Polistes ..... 17. *Xenos* Rossi.
   Parasites of Vespa ..... 18. *Vespaxenos Pierce.*

17. Genus XENOS Rossi, 1793.

Xenops Leach 1815, 1830, in Brewster's Edinburgh, Encyclopedia, vol. 9, pp. 117, 1187. *X. peckii* Kirby, *X. rossi* Kirby (*vesparum* Rossi).

Errata: Bull. 66, p. 116, lines 16, 19, 23, read "1793" for "1790." Gen. Insect. p. 24, line 28, read "1794" for "1793"; p. 26, line 14, read "114" for "14"; p. 52, lines 18, 19, read "6" for "5."

Gen. Insect, pp. 25, 26, unnumbered figures on plate 1 are not mentioned for *X. bowditchi*, *pallidus*, *pecosensis*, *wheeleri*, or *vesparum*, and unnumbered figures on plate 2 are not mentioned for *X. hubbardi* or *jurinei.*

LIST OF SPECIES OF XENOS.

1. *X. auriferi* Pierce; parasite of *Polistes aurifer* Saussure; California.

2. *X. bowditchi* Pierce; parasite of *P. pallipes* Lepeletier; Massachusetts, Ohio.

3. *X. bruesi* Pierce; parasite of *P. metricus* Say; Michigan.

4. *X. hubbardi* Pierce; parasite of *P. crinitus* Felton; Florida.

5. *X. hunteri* Pierce; parasite of *P. n. sp.* near *minor;* Texas.

6. *X. jurinei* Saunders; parasite of *P. gallicus* Linnaeus; Switzerland.

7. *X. maximus* Pierce; parasite of *P. rubiginosus* Lepeletier; Texas.

8. *X. nigrescens* Brues; parasite of *P. rubiginosus* Lepeletier; Louisiana, Texas.

9. *X. pallidus* Brues; parasite of *P. annularis* Linnaeus; Texas, Florida, Nebraska, District of Columbia.

10. *X. peckii* Kirby; parasite of *P. fuscatus* Fabricius; Massachusetts.

11. *X. pecosensis* Pierce; parasite of *P. texanus* Cresson; Texas.

12. *X. rubiginosi* Pierce; parasite of *P. rubiginosus* Lepeletier; Louisiana.

13. *X. texani* Pierce; parasite of *P. texanus* Cresson; Texas.

14. *X. wheeleri* Pierce; parasite of *P. metricus* Say; Connecticut, New York, District of Columbia.

15. *X. vesparum* Rossi; parasite of *P. gallicus* Linnaeus; Europe.

16. *X. bohlsi* Hoffman; parasite of *P. canadensis* L.; Paraguay.

4. XENOS HUBBARDI Pierce.

The mesostigmatal lobe of the male, ventral view, is figured in Genera Insectorum, plate 1, figure 3, but not mentioned in the text.

14. XENOS WHEELERI Pierce.

Errata: Gen. Insect, pl. 2, unnumbered figure, for "*Xenos roheeleri*" read "*Xenos wheeleri.*"

15. XENOS VESPARUM Rossi.

Plate 72, fig. 1.

Errata: Bull. 66, p. 116, line 27, and p. 117, lines 6, 12, read "1793" for "1790"; p. 117, line 13, read "1794" for "1793."

Gen. Insect, pl. 1, unnumbered figure, for "*Xenos resparum*" read "*Xenos vesparum.*"

An illustration is presented of the side view of a male from *Polistes gallica diadema*, collected at Innsbruck, Austria, by Mr. Karl Hofeneder.

16. XENOS BOHLSI Hoffman.

Xenos bohlsi HOFFMAN, Zool. Anz., vol. 45, pp. 100–103, 106, figs. 1, 2. Nov. 13, 1914.

Host.—Polistes canadensis Linnæus, Paraguay.

Male.—Described from specimen extracted from puparium. Length of body, 4.5 mm. Breadth of head from eye to eye, 0.95 mm. Greatest breadth of thorax, 1 mm. Length of thorax above, 2.3 mm.

Head brown, eyes deep black and stalked; antennae light brown, somewhat darker at base, the first joint enveloping the second, third and fourth ensiform, the terminal joint somewhat surpassing the third. Antennae twice as long as the head. Mandibles transparent, brownish at base, somewhat arcuate, acute, about a fourth longer than the maxilla. Maxilla consisting of basal piece and rudimentary palpus. The basal piece is relatively long, the palpus is only about one-third as long as the basal piece. Thorax dark brown, except postlumbium which is light brown. Postlumbium one-third as long as broad. Elytra somewhat longer than mesothorax. Wings reach almost to the tip of the metatarsus. Wings with seven veins arising from base. Costal area strong. Radius broken before the middle, strengthened beyond the break. Between radius and medius is one isolated branch. Between medius and cubitus, quite close to the apex of the medius lies a second detached vein. Oedeagus with basal angle rounded, greater than a rectangle, apex bent with a sharp edge, making an angle of over 45°.

Female.—Length of cephalothorax, 1.94 mm.; greatest breadth of thorax 1.62 mm., which is greater than the distance from the outside of one spiracle to the outside of the other. Brood canal opening, 0.46 mm.; its distance from apex, 0.18 mm. Openings of the brood canal, 4. Cephalothorax very dark except the anterior portions.

Triungulinid.—Length exclusive of apical stylets 0.33 mm.; breadth of abdomen, 0.11 mm.; length of head, 0.05 mm.; length of stylets, 0.16 mm. The pro- and meso- thoracic legs bear an apical pulvillus in the form of a disk; while the posterior legs have a pulvillus that is ladle form. The last three segments are different from the preceding and laterally provided with spines (Hoffman figures eleven abdominal segments).

The above descriptions are translations from Hoffman.

18. Genus VESPAEXENOS Pierce.

LIST OF SPECIES.

1. *V. buyssoni* Pierce; parasite of *Vespa ducalis* Smith; Annam.
2. *V. crabronis* Pierce; parasite of *V. crabro* Linnaeus, Japan.
3. *V. moutoni* Buysson; parasite of *V. mandarina* Smith, *V. magnifica* Smith, *V. nigrans* Buysson; China.

19. Genus BELONOGASTECHTHRUS Pierce.

1. *B. zavattarii Pierce;* parasite of *Belonogaster elegans* Gerstaecker; Congo Free State.

2. Tribe PSEUDOXENINI Pierce.

Table of genera.

Female cephalothorax broadly oval, unevenly rounded from base to apex, broadest behind spiracles; angled at base of head, obtusely rounded at apex ..... 20. *Pseudoxenos* Saunders.

Female cephalothorax broader than long, constricted at base, broadest at spiracles, convex from base to spiracles, slightly oblique, but very nearly straight from spiracles to base of head, at which point there is a slight emargination, thence very oblique to mandibles, apex convex.

21. *Monobiaphila* Pierce.

20. Genus PSEUDOXENOS Saunders.

LIST OF SPECIES.

1. *P. arvensidis* Pierce; parasite of *Odynerus arvensis* Saussure; Illinois.

2. *P. corcyricus* Saunders; parasite of *O. spinipes* Linnaeus; Corcyra.

3. *P erynnidis* Pierce; parasite of *O. erynnys* Lepeletier; Florida.

4. *P. foraminati* Pierce; parasite of *O. foraminatus* Saussure; Illinois.

5. *P. fundati* Pierce; parasite of *O. fundatus* Cresson; Illinois.

6. *P. heydenii* Saunders; parasite of *O. deflendus* Saunders; Epirus, Corcyra.

7. *P. histrionis* Pierce; parasite of *O. histrio* Lepeletier; Florida.

8. *P. hookeri* Pierce; parasite of *O. verus* Cresson; Texas.

9. *P. jonesi* Pierce; parasite of *O. colon* Cresson; Louisiana.

10. *P. klugii* Saunders; parasite of *O. laevipes* Shuckard; Epirus.

11. *P. louisianae* Pierce; parasite of *O. vagans* Sausure; Louisiana.

12. *P. neomexicana* Pierce; parasite of *O. toas* Cresson; New Mexico.

13. *P. pedestridis* Pierce; parasite of *O. pedestris* Saussure; Illinois.

14. *P. robertsoni* Pierce; parasite of *O. histrionalis* Robertson; Illinois.

15. *P. schaumii* Saunders; parasite of *O. parietum* Linnaeus; Corcyra.

16. *P. tigridis* Pierce; parasite of *O. tigris* Saussure; Illinois.

6. PSEUDOXENOS HEYDENII Saunders.

Erratum: Gen. Insect. p. 27, line 28, read "p. 141" for "p. 17." The latter page is that given in the separates.

10. PSEUDOXENOS KLUGII Saunders.

Erratum: Gen. Insect. p. 27, line 40, read "p. 142" for "p. 18." The latter page is that given in the separates.

12. PSEUDOXENOS NEOMEXICANUS, new species.

Plate 72, figs. 2–7.

Described from a male extracted from the puparium in a female *Odynerus toas* Cresson var. (determined by Rohwer) collected at Albuquerque, New Mexico, and labeled No. 2934.

Length at least 2.7 mm.; the head and thorax measure 2.1 mm. in length and 0.8 mm. in breadth. Color, dark brown; eyes, black; antennae, light brown; elytra and abdomen still lighter; legs, transparent yellow.

Head, broad; eyes, many faceted, on broad bases; head deeply emarginate between eyes with occiput strongly projecting from the emargination and antennae set on the sides of the prolongation. Front triangularly projecting beneath attachment of antennae. Antennae with second joint shorter than first and ringlike. They are not different from the usual Xenid type. Mandibles elongate, ensiform. Maxillae two-jointed, the first longer. Pronotum transverse, slightly arched forward. Mesonotum with a small anterior detached piece; the posterior angles strongly produced; pleural spiracular lobe beneath elytra of the same shape as in *Xenos*. Metathorax of the usual size. Praescutum keystone-shaped. Scuti broadest behind the base at the attachment of the wings; narrowly separated medianly by the scutellum; divided to form diagonal parascutellum. Scutellum elongate, pedunculate at posterior angles, triangularly produced in front between scuti, rounded at apex; postlumbium transverse, wrinkled, not heavily chitinized; postscutellum elongate, normal. Wings with the normal veins, and two small detached pieces beyond tip of radius. Oedeagus as in *Xenos*. (See pl. 72, fig. 7.)

This is the first male of the genus for America and the first seen by the writer. Whether our American species are congeneric with the European can not yet be determined.

Type.—Cat. No. 21449, U.S.N.M.

21. Genus MONOBIAPHILA Pierce.

1. *M. bishoppi* Pierce; parasite of *Monobia quadridens* Linnaeus, Texas.

3. Tribe TACHYTIXENINI Pierce.

22. Genus TACHYTIXENOS Pierce.

1. *T. indicus* Pierce; parasite of *Tachytes xenoferus* Rohwer; India.

4. Tribe OPHTHALMOCHLINI Pierce.

Table of genera.

Female cephalothorax widest behind spiracles, more or less evenly convex throughout; spiracles dorsal. Male scutellum not locked by the scuti; postlumbium not of a different consistency from the other parts. Parasites of *Sphex*, *Psammophila*, and *Miscus*_____23. *Eupathocera* Pierce.

Female cephalothorax broader than long, margins irregularly convex, constricted at base, rounded at apex. Male scutellum locked by scuti; postlumbium of a different consistency from the other parts. Parasite of *Chlorion*_____24. *Ophthalmochlus* Pierce.

Female cephalothorax slightly constricted at base, thence obliquely widening to widest point, just behind the spiracles, which are lateral, but hardly prominent, thence sinuately convex to apex. Parasites of *Sceliphron*.

25. *Sceliphronecchthrus* Pierce.

23. Genus EUPATHOCERA Pierce.

LIST OF SPECIES.

1. *E. lugubris* Pierce; parasite of *Sphex* (*Ammophila*) *fragilis* Smith; Ohio.

2. *E. pictipennidis* Pierce; parasite of *S.* (*A*) *pictipennis* Walsh; Illinois.

3. *E. pruinosae* Pierce; parasite of *S.* (*A.*) *pruinosa* Cresson; Colorado.

4. *E. sphecidarum* Dufour; parasite of *S.* (*A*) *sabulosa* Linnaeus; France, Germany.

5. *E. vulgaridis* Pierce; parasite of *S.* (*A.*) *vulgaris* Cresson; Illinois.

6. *E. luctuosae* Pierce; parasite of *S.* (*Psammophila*) *luctuosa* F. Smith; Idaho, Colorado.

7. *E. sieboldii* Saunders; parasite of *Miscus campestris* Latreille; Germany.

20. Genus OPHTHALMOCHLUS Pierce.

Table of subgenera.

Parasites of *Chlorion* (*Prionony.r*)_____1. *Ophthalmochlus* Pierce.
Parasites of *Chlorion* (*Proterosphex*)_____2. *Homilops* Pierce.
Parasites of *Chlorion* (*Isodontia*)_____3. *Isodontiphila* Pierce.

LIST OF SPECIES.

1. *O.* (*O*) *duryi* Pierce; parasite of *C.* (*Prionony.r*) *atrata* Lepeletier; Ohio.

2. *O.* (*H*) *abbotti* Pierce; parasite of *C.* (*Proterosphex*), species; Siam.

3. *O.* (*H*) *ashmeadi* Pierce; parasite of *C.* (*P.*) *pernanum* Kohl; Santo Domingo.

4. *O.* (*H*) *bishoppi* Pierce; parasite of *C.* (*P.*) *ichneumoneum* Linnaeus; Texas.

5. *O.* (*H*) *westwood* Pierce; parasite of *C.* (*P.*) *ichneumoneum auriffuum* Perty; Brazil.

6. *O.* (*I*) *auripedis* Pierce; parasite of *C.* (*I.*) *auripes* Fernald; Pennsylvania.

1. OPHTHALMOCHLUS DURYI Pierce.

Errata: Gen. Insect. p. 30, line 30, add "pl. 2, unnumbered figure."

5. OPHTHALMOCHLUS (HOMILOPS) WESTWOODI Templeton.

Errata: Gen. Insect. p. 31, line 8, change "(1838)" to read "(1841)"; line 10, add "pl. 2, unnumbered figure"; pl. 2, unnumbered figure, for "*Eupathocera Westwoodi*" read "*Ophthalmochlus Westwoodi.*"

25. Genus SCELIPHRONECHTHRUS Pierce.

1. *S. fasciati* Pierce; parasite of *Sceliphron fasciatus* Lepeletier; Santo Domingo.

5. Tribe PARAXENINI Pierce.

26. Genus PARAXENOS Saunders.

1. *P. erberi* Saunders; parasite of *Bembecinus peregrinus* Smith, Corcyra.

IV. Superfamily HALICTOPHAGOIDEA Pierce.

Table of families.

Male antennae four-jointed, with the flagellum of the third and the fourth joint elongate, subequal---------- IX. DIOZOCERIDAE Pierce.
Male antennae seven-jointed, with the third, fourth, fifth, and sixth joints laterally produced, and the seventh elongate-- X. HALICTOPHAGIDAE Pierce.

IX. Family DIOZOCERIDAE Pierce.

Errata: Bull. 66, pl. 14. Read "Males" for "Females."

27. Genus DIOZOCERA Pierce.

1. *D. insularum* Pierce; parasite of *Xerophloea viridis* Fabricus, Grenada, St. Vincent.

1. DIOZOCERA INSULARUM Pierce.

Plate 78, fig. 7.

An illustration of the side view of the male is presented. This shows the line separating scutum from parascutellum reaching the apex of scutellum rather than behind the middle, as usual in the other families. The pleural suture is very strongly bent at the apex of episternum and reaches the coxa.

X. Family HALICTOPHAGIDAE Pierce.

This family is probably one of the largest in the order. It now comprises 16 genera. Many more species are in the author's collection from various parts of the world and will be described in subsequent papers. The distribution of the genera is as follows:

Halictophagus Dale, 1 species; England.
Tettigoxenos Jeannel, 1 species; British East Africa.
Pyrilloxenos Pierce, 1 species; India.
Pentacladocera Pierce, 1 species; Australia.
Neocholax Pierce, 1 species; Java.
Muirixenos Pierce, 2 species; Java.
Anthericomma Pierce, 1 species; New Mexico.
Pentozoe Pierce, 1 species; Ceylon.

Dacyrtocara Pierce, 2 species; Georgia.
Pentozocera Pierce, 4 species; Queensland, Guatemala.
Cyrtocaraxenos Pierce, 1 species; Java.
Delphacixenos Pierce, 1 species; Russia.
Stenocranophilus Pierce, 1 species; Porto Rico.
Agalliaphagus Pierce, 2 species; Ohio, Maryland.
Colacina Westwood, 1, species; Borneo.
Megalechthrus Perkins, 1 species; Queensland.

Errata: Bull. 66, pl. 14, read "males" for "females." Gen. Insect, p. 39, line 19, change "Prothorax bank-like" to read "Prothorax band-like."

Table of genera.

1. Males known ..... 1.
   Males unknown ..... 13.
2. Prothorax bandlike, not pushed forward into head; wings with 7 primary veins, and 2 distal detached veins between radius and medius ..... 3.
   Prothorax pushed forward into head; wings with 6 or 7 primary veins, and 2 distal detached veins between radius and medius ..... 5.
3. Median vein broken, or with detached vein commencing just before its apex on the anal side; metathoracic praescutum and scuti very long, scutellum much shorter ..... 28. *Halictophagus* Dale.
   Median vein not broken or with detached piece on its anal side; metathoracic praescutum and scuti only moderately long, scutellum more than half as long as praescutum ..... 4.
4. Mandibles and maxillae arising closer to the eyes than the length of the basal joint of maxillae; oedeagus slender, basally arcuate, apically acutely barbed, the outside angle between the outer edges of the hook and the main tube being very acute ..... 29. *Tettigoxenos* Jeannel.
   Mandibles and maxillae arising at a distance from the eyes at least equal to the length of the basal joint of the maxillae; oedeagus stout, siphonate, greatly inflated at middle, outside angle little less than a right angle ..... 30. *Pyrilloxenos* Pierce.
5. Prothorax arched forward into head ..... 6.
   Prothorax so deeply embedded in head that the pleurae can not be seen ..... 8.
6. Wings with 7 primary veins; head transverse, not greatly arched, but emarginate behind; metapraescutum broad and about twice as long as scutellum ..... 31. *Pentacladocera* Pierce.
   Wings with six primary veins ..... 7.
7. Median vein broken, with detached part on anal side; antennae normally flabellate, the flabellae longer than the basal portions of the joints. 32. *Neocholax* Pierce.
   Median vein not broken; antennae with sixth joint attached at middle of fifth, and seventh beyond middle of sixth ..... 33. *Muirixenos*, new genus.
8. Wings with 7 primary veins ..... 9.
   Wings with 6 primary veins ..... 12.
9. Metapraescutum over twice as long as scutellum, very broad its whole length, pronotum subquadrate, embedded in head and mesonotum. 34. *Anthericomma* Pierce.
   Metapraescutum not twice as long as scutellum ..... 10.
10. Oedeagus with apex reflected ..... 11.
    Oedeagus with apex reflected and outer angle produced, acutely; scutellum widely separated from praescutum ..... 35. *Dacyrtocara*, new genus.

11. Scutellum narrowly lobate in front, very narrowly separated from praescutum; oedeagus slender, inflated at base and strongly arched, thence becoming very slender and at apex acutely reflexed___ 36. *Pentozoe* Pierce.
Scutellum convex, not lobate in front, more widely separated from praescutum; oedeagus slender, not greatly enlarged at base and obtusely angulate, but acutely angulate at apex_____ 37. *Pentozocera* Pierce.
Scutellum broadly sinuately rounded in front, broadly separated from praescutum; oedeagus slightly rounded at base, acutely barbed at apex. 38. *Cyrtocaraxenos*, new genus.
12. Fifth and sixth antennal joints merely pectinate, elongate; metapraescutum but little longer than scutellum_____ 39. *Delphacixenos*, new genus.
Fifth and sixth antennal joints normally flabellate; metapraescutum almost twice as long as scutellum_____ 40. *Stenocranophilus* Pierce.
13. Parasite of *Agallia*_____ 41. *Agalliaphagus* Pierce.
Parasites of *Epora*_____ 42. *Colacina* Westwood.
Parasites of *Platybrachys*, female cephalothorax with narrow transverse slit; thorax longer than head, gradually narrowed to base: sides of head convex_____ 42. *Megalechthrus* Perkins.

28. Genus HALICTOPHAGUS Dale.

1. *H. curtisii* Dale; host unknown; England.

Dale (1841) records collecting specimens of males on and near the Isle of Portland, England, June 16, July 15, and August 1, 1840.

29. Genus TETTIGOXENOS Jeannel.

Tettigoxenos JEANNEL, 1913, Voyage de Ch. Alluaud et R. Jeannel en Afrique Orientale (1911–1912) Insects Strepsiptères, Paris, A. Schulz, pp. 1–8, 1 fig., pl. 1, April 23.

The following description is a translation from the original, with additions in brackets:

Front excavated between the antennae: antennae 7-jointed, with last 5 laterally flabellate. Prothorax annular, narrow, not arcuate in front. Elytra long, clavate. Wings with "6" [really 7] primary veins; costal [subcostal], radial, medial and three anal; a detached branch of radius and a detached branch in front of medius; medius not broken; cubitus lacking. Metanotum strongly developed; postlumbium membranous. Metasternum formed of two pieces entirely separated on the median line. Legs short, tibiae flattened, tarsi 3-jointed. Oedeagus strongly arcuate at base, reflexed in an acute angle and very pointed at extremity. [This oedeagus is barbed as in *Cyrtocaraxenos* but more arcuate at base.]

Type of the genus.—*Tettigoxenos cladoceras* Jeannel, 1913, from British East Africa. Hosts unknown. Female unknown.

TETTIGOXENOS CLADOCERAS Jeannel.

Tettigoxenos cladoceras JEANNEL, 1913, Insects strepsiptéres, pp. 1–8, pl. 1.

Host.—Unknown. Described from a male caught at light on the River Ramisi south of Mombasa, station No. 8, British East Africa, November, 1911, and now in the Museum of Paris.

Following is a translation of the original description, with comments in brackets:

Male.—Length 2.75 mm.; wing expanse 3.5 mm. Color brilliant pitchy-brown. Form rather slender, with abdomen elongate, as long as the costal margin of the wings.

Head very large, transverse, slightly deflexed. Front concave between antennae which are attached beneath little angular salients. Eyes enormous on great peduncles, hemispherical, with fifty great ocelli. Face with rudimentary mandibles [as illustrated for *Cyrtocaraxenos*] and maxillae without lacinia [Jeannel's illustration, fig. 3, is apparently at fault in the delineation of the maxillae]. Antennae slender, first two joints simple, cylindrical, the first a little longer than broad, the second almost as long as broad; joints 3 and 4 almost as long as joint 2; joint 5 half as long, very flat, joint 6 a little longer but smaller; joints 3 to 6 laterally flabellate, strongly punctate [rather, provided with organs of sense]; flabellum of third about one-fifth longer than that of the fifth; joint 7 similarly elongate, as long as flabellum of fourth and longer than fifth.

Prothorax annular, not anteriorly arched, slightly longer on dorsum, separated from mesothorax by intersegmental skin, on which are a number of small chitinous sclerites. Mesothorax formed of a transverse mesonotum, a little mesosternal piece, and large oblique pleural pieces. Elytra inserted at upper edge of mesopleural piece, with a small V-shaped stigmatal piece covering the orifice of the spiracle at its base. Coxal cavities open behind. Metanotum composed of triangular praescutum flanked by "pleuri" [scuti] a little longer than itself; scutellum transverse pentagonal; [parascutellum oblique, subquadrate]; postlumbium membranous; postscutellum very large, navicular, covering first two abdominal segments. Metasternum formed of two elongate pieces in juxtaposition on median line. [This is the line of the furca, usually found only on the sternellum.]

Abdomen with 10 segments. Sternites more strongly chitinized than tergites. [Jeannel has misinterpreted the last three segments. He calls the eighth the ninth, and calls the ninth the tenth, and the tenth the anal tube. He refers to the ninth and tenth as the "podex." In reality, the eighth segment is ventrally produced to an acute point, reaching as far as the ninth. The ninth is likewise normally produced and concave, bearing at its extremity the oedeagus. The dorsal portion of the ninth is not shown in Jeannel's drawings. The tenth is like a flap over the oedeagus.]

Female.—Unknown.

30. Genus PYRILLOXENOS Pierce.

Pyrilloxenos PIERCE, 1914, Proc. Ent. Soc. Wash., vol. 16, p. 128.

Male.—Head not conspicuously excavated behind. Eyes large, convex with very large facets. Mandibles short, triangular, glabrous. Antennae short, seven jointed, flattened, foliaceous, with large sensory pits; first two joints simple, the second shorter; the remaining five joints crowded, each broadened laterally in a broad lamina, the apices of which are about even with each other, the entire antennae not longer than width of head.

Pronotum very short, transverse band-like. Mesonotum a little longer, also band-like. Elytra pedunculate spatulate, sensitive, pubescent. Metanotum with praescutum rounded, keystone-shape, truncate, sinuate at apex, longer than scutellum and postlumbium together; scuti oblique, considerably surpassing praescutum at outer angles and supporting it by a tiny projection at inner angles; scutellum broad, irregular in outline, narrower at base than praescutum, broadening in a concave line behind scuti, with anterior angles rounded, almost rectangular, and posterior angles diagonally produced as quadrate peduncles, apex otherwise truncate; postlumbium short, transverse, fitting in between and scarcely surpassing the posterior peduncles of the scutellum; postscutellum large, convex, broadly rounded.

Tarsi three-jointed, the first joint mucronate; claws absent. Eighth ventral segment acutely produced beneath ninth. Anal segment small, flap-like. Oedeagus strongly bent, broad near base, rectangularly bent near apex, apical process slender and very acute.

The generic name is derived from *Pyrilla* (the host genus) + *Xenos* (the typical Strepsipterous genus) signifying a Strepsipterous parasite of *Pyrilla.*

Type of the genus.—*Pyrilloxenos compactus* Pierce, from India.

PYRILLOXENOS COMPACTUS Pierce.

Plate 77.

Pyrilloxenos compactus PIERCE, Proc. Ent. Soc. Wash., 1914, vol. 16, p. 129.

Described from a type female and allotype male and two paratype females from Pusa, Bihar, India, collected by C. S. Misra.

The original description is as follows:

The material was collected in August, 1907; March 15, 1913; and May 23, 1914. The specimens collected in August, 1907, consist of allotype male, pupal cephalothorax, and three paratype females with triungulinids. This material is the property of the Entomological Section, Agricultural Research Institute, Pusa. The type is deposited in the United States National Museum, and a paratype female is in the author's collection. The author is indebted to Mr. T. Bainbridge Fletcher, imperial entomologist, for the material. The specific name

is intended to draw attention to the compact appearance of the antennae.

Male.—Length, 1.5 mm. The tarsi are very small. The anterior tibiae are very robust and shorter than on the other legs. The antennae are much more compact than is usual in this family. The mandibles can not meet. The remainder of the description is to be drawn from the generic description. The specimen was, unfortunately, boiled in caustic potash and is therefore very hard to study.

Female.—Cephalothorax golden yellow to brownish, broader than long; constricted behind spiracles; sides quite evenly rounded; apex sinuate. Mandibles obtuse, separated by almost three times their width. Front convex. Spiracles just touching margin.

Type.—Cat. No. 18814, U.S.N.M.

The illustrations in plate 77 bring out a number of features not covered by the original descriptions.

The prosternum is composed of a narrow transverse eusternum and the medially divided sternellum which forms a half ring for attachment of the coxae. This ring is undoubtedly composed of sternellum, precoxale, and trochantin. At the lateral horn this piece, together with the epimeron and episternum, separated by the pleural suture, meet the coxa. The coxa is a small piece at the base of the elongate trochanter (pl. 77, fig. 2). The pronotum is largely of one piece, with small lateral pieces, probably scuti.

The mesonotum is shorter on the median line than at the sides. A semilunar piece in front is apparently the praescutum, the remainder is the scutoscutellum. The sternum is the most perfectly formed of any yet seen in the order. The eusternum is triangular. The antecoxal ring is composed of three distinct pieces. The inner pieces of the ring are the sternellar pieces longitudinally separated; the median piece is the precoxale. The coxale attachment is at the outer horn, where three pieces—trochantin, episternum, and epimeron—meet. The coxa is a minute piece at the base of the elongate trochanter (pl. 77, fig. 3).

The metasternum has eusternum separated from sternellum by a sinuate line. Episternum does not reach the coxa, although the pleural suture does. The epimera are very large and almost surround the coxae, which are more closely connected to the sternellum than in the anterior segments (pl. 77, fig. 4).

31. Genus PENTACLADOCERA Pierce.

1. *P. schwarzi* Perkins; parasite of *Agallia*, species; New South Wales.

1. PENTACLADOCERA SCHWARZII Perkins.

Errata: Gen. Insect., p. 37, line 6, change "p. 6" to read "pl. 4."

32. Genus NEOCHOLAX Pierce.

1. *N. jacobsoni* Meijere; parasite of *Ossoides lineatus* Bierman; Java.

33. Genus MUIRIXENOS, new genus.

Named in honor of Frederick Muir, the collector of the species on which this genus is founded, and of many other species in the author's collection to be described later. Probably no collector has ever shown a greater aptitude for collecting species of this order than Mr. Muir, whose travels have taken him to many parts of the world.

The genus is characterized by its elongate narrow body, arcuate head, antennae with the last two joints attached far from the base of the preceding (pl. 76, figs. 1, 2); prothorax band-like, transverse above but laterally strongly diagonally flexed forward; mesothorax distinctly composed of three transverse pieces; metathorax with praescutum reaching scutellum and almost twice as long, scuti divided; eighth segment ventrally produced beneath ninth; wings lacking cubitus and one anal vein, medius not broken.

Type of the genus.—Muirixenos dicranotropidis Pierce, from Java.

The genus is easily separable from the other Javan genera *Neocholax* and *Cyrtocaraxenos* by the characters given above and in the table of genera.

1. MUIRIXENOS DICRANOTROPIDIS, new species.

Plate 76, fig. 1.

Described from a male bred from *Dicranotropis muiri* Kirkaldy collected in Java by F. Muir under the number 333.

Length, 1 mm. Color, light brown. Head strongly arched. Prothorax dorsally transverse but with pleurae diagonal, carrying the dorsum far anterior to the sternum. Mesothorax with praescutum semilunar, scutum transverse, and scutellum transverse. The metathoracic parts are well illustrated in figure 1, plate 76.

Type.—Cat. No. 21450, U.S.N.M.

2. MUIRIXENOS PERKINSIELLAE, new species.

Plate 76, figs. 2–5.

Described from a male bred from *Perkinsiella saccharicida* Kirkaldy collected in Java by F. Muir under the number 316.

Length slightly under 1 mm. Lighter in color, almost yellowish. It differs very slightly from the preceding. The oedeagus, antenna, tarsus, and side view of thorax are illustrated.

The episternum reaches closer to the coxal cavity than in any other species yet seen, but does not reach it.

Type.—Cat. No. 21451, U.S.N.M.

34. Genus ANTHERICOMMA Pierce.

1. *A. barberi* Pierce; host unknown, New Mexico.

1. ANTHERICOMMA BARBERI Pierce.

Errata: Gen. Insect. p. 36, line 25, add "Pl. 3, unnumbered figure."

35. DACYRTOCARA, new genus.

Name derived from δα (strongly) + κυρτὸς (curved) + κάρα (head), meaning strongly arched head.

Male.—Head strongly arched, inclosing the pronotum and part of mesonotum; antennae typical five-branched, the branches subequal, the bases of the joints short. Mesonotum distinctly divided into three transverse sclerites. Metapraescutum not reaching and not greatly longer than scutellum. Wings with seven principal veins, two detached veins between radius and medius, and with the medius broken. Oedeagus nearly straight, flexed near apex with outer angle prolonged almost as long as the prong.

Type of the genus.—Dacyrtocara oncometopiae, new species.

Species: 1. *D. oncometopiae*, from *Oncometopia lateralis* Fabricius; Egypt, Georgia.

2. *D. undata*, from *O. undata* Fabricius; Thomasville, Georgia.

1. DACYRTOCARA ONCOMETOPIAE, new species.

Plate 74, figs. 1–4.

Described from one male and two puparia extracted from a single *Oncometopia lateralis* Fabricius, determined by the late Otto Heidemann, collected by W. H. Finn at Egypt, Georgia, from the Uhler collection in the United States National Museum. The male was in perfect condition and ready to emerge when killed.

Male.—Length, 3.3 mm.; wing expanse at least 5 mm. Color brown. Head emarginate above for reception of prothorax, not emarginate below. Eyes on broad stalks, not very closely fascicled. Antennae with flabellae closely appressed. Mandibles short, not reaching mouth opening. Maxillae 2-jointed, the joints about equal.

Pronotum semilunar with pleurae extending diagonally backward; prosternum composed of two pieces medianly separated, which correspond to the sternellum+precoxale+trochantin; coxae minute, trochanters elongate, femora very little longer, tibiae shorter and enlarged at apex, tarsi 3-jointed, with first joint very broad and remaining joints elongate. Mesonotum with a semilunar praescutum, transverse scutum and scutellum; elytra clavate; pleural spiracles protected by an episternal lobe beneath elytra; epimeron, episternum and trochantin forming hook for attachment of coxa; trochantin, precoxale and sternellum forming open ring around coxal cavity; eusternum large and triangular; sternellum bilobed; coxa minute

at base of elongate trochanter, femur longer, tibia still longer, tarsus with first joint mucronate, others pulvillate. Metanotum with keystone-shaped praescutum, connected scuti, diagonal parascutellum, transverse, anteriorly sinuate scutellum, membranous postlumbium, and very long postscutellum; wings normal; episternum not reaching coxa; epimeron reaching coxa; eusternum separated from sternellum by a line diverging posteriorly from median line; coxa very large; trochanter smaller and cup shaped; femur, and tibia elongate; tarsus as in middle leg. Oedeagus straight to angle of reflexion, outer angle produced downward as illustrated (pl. 74, fig. 4).

Type.—Cat. No. 21452, U.S.N.M.

2. DACYRTOCARA UNDATA, new species.

Plate 74, figs. 5, 6.

Described from two females found in the fourth and fifth segments of a female *Oncometopia undata* Fabricius, captured by George D. Smith at Thomasville, Georgia, in May, 1915. The host died May 10.

Length, 7 mm. Color of cephalothorax dark brown with large rounded brown spot on first ventral segment; brood canal slightly darkened; abdomen otherwise white until mature, when it becomes brown.

Cephalothorax elongate, apically rounded, slightly sinuate in front of mandibles and laterally slightly compressed opposite opening of brood canal, which is behind the middle. Mandibles broad, obtuse. Brood canal opening a transverse narrow slit on the venter. Base of cephalothorax strongly constricted. Thoracic spiracles lateral and inconspicuous.

The brood canal extends back only four segments, and there are only two median genital tubes opening into it, on the second and third segments. At the edge of the brood canal at the posterior margin of the first, second, and third segments are simple spiracles consisting of mere slitlike openings. The tracheae can be seen leading from them. The first abdominal segment within the body of the host extends far beyond the tip of the cephalothorax.

Type.—Cat. No. 21453, U.S.N.M.

36. Genus PENTOZOE Pierce.

1. *P. peradeniya* Pierce; parasite of *Thompsoniella arcuata* Motschulsky; Ceylon.

1. PENTOZOE PERADENIYA Pierce.

Errata: Gen. Insect. p. 38, line 6, change "Fig. 40" to read "Fig. 44."

37. Genus PENTOZOCERA Pierce.

1. *P. australensis* Perkins; parasite of *Tetigonia parthaon* Kirkaldy; Queensland.

2. *P. phaeodes* Perkins; parasite of *Hecalus immaculatus* Kirkaldy.

3. *P. stenodes* Perkins; parasite *Paradorydium menalus* Kirkaldy; Queensland.

4. *P. schwarzi* Pierce; parasite of *Diedrocephala sanguinolenta* Coquibar; Guatemala.

38. CYRTOCARAXENOS, new genus.

Name derived from κυρτὸς (curved) + κάρα (head) + *Xenos*.

Characterized by a very large head, emarginate behind, with tremendous eyes; antennae with branches closely appressed, not surpassing one another. Prothorax quadrate invisible at sides. Metanotum with only two transverse areas. Metapraescutum broadly separated from scutellum but considerably longer than the same. Eighth abdominal segment greatly produced beneath the ninth. Oedeagus barbed at apex.

Type of the genus.—Cyrtocaraxenos javanensis, new species; Java.

CYRTOCARAXENOS JAVANENSIS, new species.

Plate 78, figs. 1–6.

Collected at light, 800 feet altitude, at Buitenzorg, West Java, December, 1908, by W. Terry, and presented by Mr. F. Muir.

Length about 2 mm.; dark brown. Head emarginate from dorsal and anterior views for reception of pronotum. Mandible short, but reaching mouth. Maxillae short, 2-jointed, the joints very broad and subequal. Pronotum trapezoidal. Mesonotum transversely divided, posteriorly produced at angles. Metanotum with praescutum keystone shaped, broad at apex, broadly separated from scutellum by scutum; parascutellum diagonal; scutellum transverse; sinuate in front; postlumbium short and transverse; postscutellum very large. Legs normal, first tarsal joints mucronate. Oedeagus slightly curved, with apex sharply reflexed, the inner and outer angles being very acute. Wings with seven principle veins, and with two detached beins between radius and medius; medius not broken.

Type.—Cat. No. 21454, U.S.N.M.

39. DELPHACIXENOS, new genus.

The generic name is derived from *Delphax* (the host genus)+ *Xenos* (the typical Strepsipterous genus), signifying a strepsipterous parasite of Delphax.

Male.—Head excavated behind, seen from above consisting of a narrow arcuate rim supporting the eyes and produced somewhat in front of these to form the apex of the frontal projection, at the sides of which the antennae are inserted. Eyes large, convex, reaching the base of the elytra when the body is compressed; facets large and

separate. Mandibles reaching to the mouth opening, about three times as long as broad, acute. Maxillae longer, two jointed, cylindrical, the first joint shorter and subclavate; the second joint, or palpus almost twice as long as first and tapering, longer than mandibles. Antennae elongate, seven jointed, foliaceous with sensory pits: first two joints simple, the first shortest; third about as long as first with long lateral sensitive flabellum: fourth longer than second in apical half laterally produced into a flabellum about half as long as that of the third; fifth joint longer than fourth with a short apical lateral projection not much longer than the width of the joint, sixth joint about as long as fourth merely with a tooth-like enlargement at tip: seventh joint longest of all. Pronotum merely a small transverse plate set into the emargination of the head. Mesonotum with two plates the first in the emargination of the head and the second band-like, not covered by head. Elytra elongate, clavate. Metanotum with praescutum rounded keystone-shaped: scuti oblique slightly surpassing praescutum: scutellum transverse laterally pedunculate at apex on each side; postlumbium semicircular of different consistency from other parts; postscutellum elongate, broad; epimeron (femoralium) reaching almost to tip of postscutellum. Wings with costa very short and basal, closely united with subcosta which braces the costal margin to the middle of the wing; radius and medius at base are closely connected with the subcosta, the radius being very weak and indistinct except as detached portions in the nodal region; medius strong in its basal half, distinct, and thence forked in two infuscated branches which reach the outer margin; cubitus missing; first anal merely an infuscation: second anal strong: third anal missing. Tarsi 3-jointed, the first joint on the meso- and meta-tarsi differently shaped from the following joints. Oedeagus strongly bent, basally inflated; the under side being twice bent and the upper twice; the last bend being a strong reflexion near the slender acute apex.

Type of the genus.—Delphacixenos anomalocerus, new species; parasitic on *Delphax striatella* Fabricius; Russia.

1. DELPHACIXENOS ANOMALOCERUS, new species.

Plate 75, figs. 1–6.

Described from five males mounted on a single slide, which were bred May 4–7 from *Delphax striatella* Fabricius by A. A. Ogloblin at Poltava, Russia, and presented to the writer by Prof. N. Kourdumoff.

Male.—Length, 1.2 mm.; wing expanse, about 2.5 mm. Color, brown; with postlumbium, abdomen, except two last segments and venter, anterior portion of epimeron (femoralium), and anterior portion of sternum, yellow: appendages very light yellowish brown.

The buccal area is inflated with a tiny mouth opening. The anterior and median coxae are elongate and grooved on the inner side; the posterior coxae are only half as long as the others and so attached that, from a straight ventral view, the attachment can not be seen. The femora and tibiae are subequal, the anterior pair being shortest; the median and posterior tibiae are dorsally grooved. The median and posterior tarsi have the first joint mucronate at tip; all tarsal joints are pulvillate beneath.

The prothorix consists of a single notal sclerite and two small sternal pieces (each composed of sternellum+precoxale+trochantin) to which the coxae are attached. The mesonotum has two dorsal sclerites, a diagonal pleurum and a small sternum. The praescutum is subtriangular; the scuti are narrowly connected by a separate scutal area; scutellum is transverse quadrate with pedunculate posterior angles. In front of the praescutum is evidence of a small piece, probably the pretergite. In front of the wing is the oval prealare area. Lying over the posterior edge of this is one of the tiny sclerites to which the wing is attached. The parascutellum is oval, oblique. The tiny wing sclerites visible between this and the prealare are rather too difficult to differentiate at present. Below the postscutellum is the elongate pleurotergite, which is hooked at the front where it touches the parascutellum. The epimeron consists of a nonchitinized area beneath the parascutellum and a more or less faintly divided chitinized area behind this, with a heavily chitinized crescentiform area at the apex, to which the coxae are attached. Beneath the prealare and front part of the epimeron is the episternum, which is diagonally divided. The sternum consists of a narrow presternum and a very large elongate sternal area irregularly divided into an anterior partly chitinized yellow eusternum and a posterior chitinized sternellum, the posterior edge of which covers the insertion of the coxae. The sternellum is medianly divided almost to base.

The eighth abdominal segment is greatly prolonged beneath the ninth. The ninth segment is prolonged as usual beneath the tenth, with the oedeagus at its tip. The tenth segment is a small flap arising from the cup of the ninth in front of the oedeagus.

Type.—Cat. No. 21455, U.S.N.M.

40. Genus STENOCRANOPHILUS Pierce.

Stenocranophilus PIERCE, 1914, Proc. Ent. Soc. Wash., vol. 16, pp. 126–127.

The original description is as follows:

Male.—Head excavated behind, seen from above consisting of a narrow arcuate rim supporting the eyes and produced considerably in front of these to form the tip of the sulcate frontal projection, at the sides of which the antennae are inserted. Eyes very large, convex, reaching and touching the base of the elytra. Mandibles

very short, broad and blunt, not reaching within their own length of each other. Maxillae a little longer, two-jointed, cylindrical, the first joint almost twice as thick as the second, and neither quite as long as the mandibles. Antennae elongate, seven-jointed, flattened foliaceous, with large sensory pits; first two joints simple, third to sixth moderately elongate, each produced just before the attachment of the succeeding joint into a broad flattened lamina not much more than twice as long as the main stem; seventh joint also produced, laminate. Pronotum subquadrate, cut off at sides by head. Mesonotum band-like, also included within the cavity of the head. Elytra elongate, metanotum with praescutum elongate, convex at base, sides roundingly approximate toward apex, where they almost meet; scuti narrow, elongate, only a little longer than praescutum; scutellum broad, quadrate, basally convex, apically bisinuate, not much longer than postlumbium; postlumbium at least two-thirds as long as wide; postscutellum long, broad; epimeron [femoralium] reaching to middle of postscutellum. Wings with radial vein meeting the costal margin beyond the middle, a small detached cloudy vein behind the tip of the radius, medius strong, with a long anterior cloudy branch, cubitus missing; first anal merely a cloudy vein, second anal strong, third anal missing. Tarsi three-jointed, the first joint of different shape from the following; claws absent. Oedeagus strongly bent, the under side being twice bent and the upper thrice, the last bend being a very strong reflection at apical fourth; apex very acute.

The generic name is derived from *Stenocranus* (the host genus) +φίλος (loving), signifying a parasite of *Stenocranus*.

Type of the genus.—*Stenocranophilus quadratus* Pierce.

1. STENOCRANOPHILUS QUADRATUS Pierce.

Stenocranophilus quadratus PIERCE, 1914, Proc. Ent. Soc. Wash., vol. 16, pp. 127, 128.

Described from one type and five paratype males bred by T. H. Jones, October 19, 1912, from two females and four nymphal *Stenocranus saccharivorus* Westwood collected October 14 and 16, 1912, from sugar cane at Rio Piedras, Porto Rico, and bearing the Porto Rico Sugar Planter's Association accession number "847–1912." One paratype was returned to the association. The specific name is intended to draw attention to the quadrate form of the pronotum and the scutellum. This form of scutellum has not heretofore been found in the Halictophagidae.

Male.—Length, 0.9 mm.; wing expanse, 2 mm. Color golden brown. A few points not given in the generic description remain to be noted. The first tarsal joint is broad, apically broadest and somewhat acute on outer angle; the point of attachment of the second is subapical at

the inner angle; the point of attachment on the second joint is dorsal and very near its base; this joint and the third are both slender at base, gradually enlarged, pulvillate beneath, apically truncate. The antennae are quite long, the stem portions of the joints being longer than usual. The last joint reaches as far back as the scutellum. The length of the praescutum and scutellum about equals that of the postlumbium and postscutellum.

Female.—Cephalothorax about 0.2 mm. long, golden yellow, not much darker behind the opening of the brood canal; almost one-quarter longer than wide; sides constricted at base, parallel at middle, angulate and convergent from anterior third, sinuate at apex. Mandibles large, obtuse with outer edges marginal; front convex extending beyond mandibles and separating them by a little more than their width. Opening of brood canal broad, trapezoidal. Spiracles ventral, close to margin.

Type.—Four paratype males, and allotype female, Cat. No. 18813, U.S.N.M.

41. Genus AGALLIAPHAGUS Pierce.

1. *A. americana* Perkins; parasite of *Agallia quadrinotata;* Ohio.

2. AGALLIAPHAGUS UHLERI, new species.

Plate 73.

Described from a female from *Agallia uhleri* Van Duzee collected at Rocky Ford, Colorado.

Female.—Cephalothorax transverse. Head occupying over one-half the length, and broadly, narrowly emarginate behind, slightly convergent on sides, slightly emarginate at base of mandibles, which are closer to the oral orifice than their widths; oral orifice large and transverse. Spiracles reaching lateral margin, but not prominent. The opening of the brood canal is short and transverse.

The measurements, using the same scale as in Andrena are as follows:

Specimen	1	2	3	4	5	6	Index total.
Type	14	13	9	7	8	13	.....
Relative proportions to breadth at spiracles	1.00	0.92	0.64	0.50	0.57	0.92	4.55

This species is quite different in form from *A. americana*, differing especially in the lesser emargination of the head.

Type.—Cat. No. 21456, U.S.N.M.

42. Genus COLACINA Westwood.

This genus has been transferred to the Halictophaginae because of the nearness of its habitat and host to those of *Neocholax.*

1. *C. insidiator* Westwood: parasite of *Epora subtilis* Walker, Borneo.

43. Genus MEGALECHTHRUS Perkins.

1. *M. tryoni* Perkins; parasite of *Platybrachys*, species; Queensland.

V. Superfamily ELENCHOIDEA Pierce.

XI. Family ELENCHIDAE Pierce.

Considerable unstudied material in this family is at hand, but must remain for future consideration. Until that time it is unnecessary to prepare a table of genera.

44. Genus ELENCHUS Curtis.

1. *E. tenuicornis* Kirby; parasites of *Liburnia*, species; England.
2. *E. walkeri* Curtis; host unknown; England, Ireland.
3. *E. templetonii* Westwood; host unknown; Mauritius.
4. *E. melanias* Perkins; parasite of a Delphacid; Hawaii.

4*a*. *E. m. silvestris* Perkins; parasite of a Delphacid; Hawaii.

It is quite probable that this is a composite genus, but nothing can be done with it until the species can be studied.

Errata: Gen. Insect., p. 43, line 35, for "p. 385" read "pl. 385."

2. ELENCHUS WALKERI Curtis.

Errata: Gen. Insect., p. 44, line 20, for "p. 385" read "pl. 385."

Dale (1841) records collecting males at Glenville's Wooton, England, on June 27 and July 1, 1841.

4. ELENCHUS MELANIAS Perkins.

Elenchus melanias Perkins, 1910, Fauna Hawaiiensis, vol. 3, pt. 6, Dec. 17, p. 667.

Following is the original description:

Thorax dull brown or pitchy, head black or nearly so, abdomen black, tips of the joints of anterior tarsi pallid. Lateral branch of antennae extending nearly to their tip, second joint subglobose or subquadrate in different aspects, paler generally than the following. Wings very dark smoky black, apical dilatation of elytra deep black. Abdominal segments with interrupted white apical margins. Genital segment more or less pale within, rather broad where the sides are well angulated in front of the middle, chitinous recurved hook dilated apically and terminated in a very minute pale upturned spine. Expanse, 3.3 mm.; length, 1.5 mm. Male.

Errata: Pierce, Gen. Insect., p. 44, line 7, after "pt. 6" add "p. 667."

4*a*. ELENCHUS MELANIAS SILVESTRIS Perkins.

Very like the above, but with the wings less deeply smoke colored, and the genital segment more elongate in proportion to its width. This variety also appears to be slightly smaller than the type.

Hab. Oahu, Hawaii, and females on all the other islands. The typical form described has been taken in more open country and the var. *silvestris* in very dense, wet forests. It infests Delphacid leaf hoppers of many species and of different genera. The var. *silvestris* approaches most nearly to *E. tenuicornis*,

but the difference between the Hawaiian specimens and the examples I refer to the latter from Europe, America, Fiji, and Australia is much greater than any distinction between the individuals of *E. tenuicornis* from the above named, widely separated regions.

45. Genus DEINELENCHUS Perkins.

1. *D. australenis* Perkins; paratype of *Platybrachys*, species; Queensland.

46. Genus LIBURNELENCHUS, new name.

Mecynocera Pierce, 1908, not J. C. Thompson in Crustacea, 1888.

1. *L. koebelei* Pierce; parasite of *Liburnia campestris* Van Duzee and *L. lutulenta* Van Duzee; Ohio.

2. *L. heidemanni*, new species; parasite of *Liburnia*, species; Maryland.

1. LIBURNELENCHUS KOEBELEI Pierce.

Mecynocera koebelei PIERCE, in all previous works.

Errata: Gen. Insect., p. 44, line 43, add "Pl. 3, unnumbered figure."

2. LIBURNELENCHUS HEIDEMANNI, new species.

Plate 78, figs. 8. 9.

Described from a specimen extracted from a *Liburnia* collected at Bay Ridge, Maryland, September 1, 1902, by the late Otto Heidemann, and named in his honor.

The thorax is in general as in *L. koebelei*, but the oedeagus differs greatly, as shown in the illustrations.

Type.—Cat. No. 21457, U.S.N.M.

47. Genus ELENCHINUS, new genus.

Male.—Elongate, with slender enlongate antennae, the last joint of which would reach beyond the postlumbium. Mandibles stout, acute, over half as long as breadth between eyes; maxillae 2-jointed, the second joint longer than first. Metapraescutum, broad at base, acute at apex, not reaching the transverse scutellum. Scuti not reaching humeri, united behind praescutum. Parascutellum at sides of scutellum and diagonal. Scutellum truncate in front, with anterior angles diagonally truncate, posterior angles pedunculate, and base bisunuate. Postlumbium semilunar, membranous. Postscutellum elongate. Elytra very long, slender, clavate.

Type of the genus.—Elenchinus heidemanni, new species, from *Megamelanus* species; Maryland.

1. ELENCHINUS HEIDEMANNI, new species.

Plate 78, figs. 10–12.

Described from one male extracted from a *Megamelanus*, species collected at Bay Ridge, Maryland, September 1, 1902, by the late Otto Heidemann, in whose honor the species is named.

The description contained in the generic diagnosis is sufficient to delineate this species. The mandible, maxilla, and oedeagues are illustrated.

The oedeagus is quite distinct from that of *Liburnelenchus*.

Type.—Cat. No. 21458, U.S.N.M.

48. Genus ELENCHOIDES Pierce.

1. *E. perkinsi* Pierce; parasite of *Perkinsiella vitensis* Kirkaldy, Fiji.

49. Genus PENTAGRAMMAPHILA Pierce.

1. *P. uhleri* Pierce, parasite of *Pentagramma vittatifrons* Uhler; "Dacota."

GEOGRAPHIC DISTRIBUTION OF THE STREPSIPTERA.

In Bulletin 66, on pages 171–173, the writer presented a tabulation of the distribution of the host species according to the faunal regions described by Wallace. There were at that time records of parasitism by Strepsiptera on 50 genera and 238 species of hosts, distributed as follows:

	Species.
Nearctic, subdivision—	
1	7
2	14
3	69
4	0
Total	90
Neotropical, subdivision—	
1	3
2	10
3	3
4	3
Total	19
Palaearctic, subdivision—	
1	70
2	19
3	0
4	2
Total	91
Ethiopian, subdivision—	
1	2
2	0
3	1
4	0
Total	3

Oriental, subdivision—	
1	3
2	5
3	4
4	2
Total	14
Australian, subdivision—	
1	3
2	17
3	3
4	0
Total	23

In the following table the distribution of described parasites is tabulated for comparison. It is interesting to note that species are now described from all the geographical faunal subdivisions except four, South Africa, Central Asia, Southwest South America, and New Zealand. These regions have been the least studied entomologically, but it is to be expected that they will some day furnish many interesting species.

Table of distribution of the described species of Strepsiptera according to the geographical regions of Wallace.

	Nearctic.				Neotropical.				Palaeartic.				Ethiopian.				Oriental.				Australian.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Mengeoidea																								
Mengeidae																								
Mengea									1															
Triozocera		1					1																	
Mengenillidae																								
Mengenilla										1														
Austrostylops																						1		
Tetrozocera										1														
Stichotrematoidea																								
Stichotrematidae																								
Stichotrema																					1			
Xenoidea																								
Callipharixenidae																								
Callipharixenos																					1			
Chrysocorixenos																			1					
Myrmecolacidae																								
Myrmecolax																		1						
Caenocholax							1																	
Stylopidae																								
Stylops	5	5	22	1					11															
Katastylops		1																						
Prostylops												1												
Neostylops	1	1	1						1															
Parastylops																				1				
Hylecthridae																								
Hylecthrus										3														
Xenidae																								
Halictoxenos			7																					
Halictophilus																				2				
Halictostylops									1															
Augochlorophilus			1																					
Apractelytra			1																					
Crawfordia	1	1	4																					
Xenos	1		12			1			1															
Vespaexenos																				1	2			
Belonogastechthrus														1										
Pseudoxenos		1	11							4														
Monobiaphila			1																					
Tachytixenos																	1							
Eupathocera		2	3						2															

Opthalmochlus			1																					
Homilops			1			1		1											1					
Isodontiphila			1																					
Sceliphronechthrus								1																
Paraxenos									1															
Halictophagoidea																								
Diozoceridae																								
Diozocera								1																
Halictophagidae																								
Halictophagus									1															
Tettigoxenos														1										
Pyrilloxenos																1								
Pentacladocera																					1			
Neocholax																			1					
Muirixenos																			2					
Anthericomma		1																						
Pentozoe																		1						
Pentozocera							1														3			
Cyrtocaraxenos																			1					
Delphacixenos								1																
Stenocranophilus								1																
Agalliaphagus			2																					
Colacina																			1					
Megalechthrus																					1			
Elenchoidea																								
Elenchidae																								
Elenchus								2							1							1		
Deinelenchus																					1			
Liburnelenchus			2																					
Elenchinus			1																					
Wlenchoides																						1		
Pentagrammaphila		1																						
Subdivision totals	8	14	71	1		2	3	4	21	10		1		1	1	1	2	2	3	10	2	7	2	
Regional totals	94					9			32				3				17				11			
Grand total for world	166																							

The knowledge of the distribution of host species has been greatly increased since Bulletin 66 was published, and we may therefore present a revised summary for contract with the list of described species:

Distribution of host species and described parasite species according to regions.

Region.	Subdivision.	Host species.		Described parasites.	
		Subdivisional totals.	Regional totals.	Subdivisional totals.	Regional totals.
Nearctic	1	13		8	
	2	33		14	
	3	113		71	
	4	1	160	1	94
Neotropical	1	3		0	
	2	11		2	
	3	3		3	
	4	4	21	4	9
Palaearctic	1	73		21	
	2	23		8	
	3	0		0	
	4	3	99	1	30
Ethiopian	1	5		0	
	2	1		1	
	3	1		1	
	4	0	7	1	3
Oriental	1	7		2	
	2	6		2	
	3	5		3	
	4	9	27	10	17
Australian	1	4		2	
	2	20		7	
	3	3		2	
	4	0	27	0	11
Total for world			341		174

It will be seen from the foregoing table that only half of the recorded parasites are described. About 30 of the undescribed species are in the possession of the author and will furnish material for further studies. The indications are that tropical regions will ultimately yield more species than the temperate regions, which now stand highest because of the more intensive collecting done in them.

HOST LIST.

The following additions to the host list may be made:

HOMOPTERA.

Superfamily CICADOIDEA.

Family CICADELLIDAE (TETIGONIIDAE).

Tribe CICADELLINI (TETIGONIINI).

Cicadella Latreille (*Tettigoniella* Bergroth): *spectra* Distant, Ceylon (E. E. Green, 1912).

ZOOGEOGRAPHICAL REGIONS (AFTER WALLACE 1876)

3313—18. (To face page 486.)

Oncometopia Stål.

lateralis Fabricius (determined by O. Heidemann), Egypt, Georgia (W. H. Finn): (male, male puparia, larva); *Dacyrtocara oncometopiae* Pierce.

undata Fabricius (determined by O. Heidemann)—

1. Shreveport, Louisiana (F. W. Mally); (male exuvium).
2. Thomasville, Georgia, (G. D. Smith); (females); *Dacyrotocara undata* Pierce.

Tribe PHRYNOMORPHINI.

Deltocephalus Burmeister:

sandersi, Clarksville, Tennessee, November 10, 1915 (S. E. Crumb).

Tribe EURYMELINI.

Agallia Curtis:

species, Virginia Beach, Virginia, commonly parasitized. (E. S. Schwarz, E. S. G. Titus.)

uhleri Van Duzee (determined by O. Heidemann)—

1. Santa Cruz Mountains, California; (male exuvium).
2. Rocky Ford, Colorado, (H. O. Marsh), July 26, 1912 (male pupa and exuvium): August 24, 1912 (male exuvium); August 26, 1912 (females); September 1, 1909 (male exuvium); September 22, 1909 (female, triungulinids, male exuvium; *Agalliaphagus uhleri* Pierce.

Superfamily FULGOROIDEA.

Family ASIRACIDAE.

Perkinsiella Kirkaldy:

saccharicida Kirkaldy, Java, F. Muir (male); *Muirixenos perkinsiellae* Pierce.

Phenice Westwood:

modesta Westwood, Java, F. Muir.

Dicranotropis Fieber:

muiri Kirkaldy, Java, F. Muir (male); *Muirixenos dicranotropidis* Pierce.

Liburnia Stål:

campestris Van Duzee, Columbus, Ohio, August 11 (males), August 17 (females); *Liburnelenchus koebelei* Pierce (*Mecynocera*) (Collection U. S. National Museum), (Pierce 1909, Bull. 66, p. 178).

lutulenta Van Duzee. 1. Columbus, Ohio, August 11 (male); *Liburnelenchus koebelei* Pierce. (*Mecynocera*), (*Elenchus tenuicornis* Perkins), (Perkins 1905; Pierce 1909; Bull. 66, p. 178).

Stenocranus Fieber:

saccharivora Westwood, Rio Piedras, Porto Rico, on sugar cane, October 14–19, 1912 (T. H. Jones), (males); November, 1913 (T. H. Jones), (males and females); *Stenocranophilus quadratus* Pierce (Pierce 1914).

Delphax Latreille:

striatella Fabricius, Poltava, Russia, May, 4–7; (males, females): *Delphacixenos anomalocerus* Pierce.

Family POEKILLOPTERIDAE.

Subfamily TROPIDUCHINAE.

Ossoides Bierman:

lineatus Bierman, Semarang, Java, June and July, 1905 (Edward Jacobson), (male); *Neocholax jacobsoni* Meijere (Meijere 1911).

Family LOPHOPIDAE.

Pyrilla Stål:

aberrans Distant, Pusa, Bihar, India, on sugar cane, August, 1907, March 15, 1913, May 23, 1914. (C. S. Misra), (males and females); *Pyrilloxenos quadratus* Pierce (Pierce 1914).

pusana Distant, Pusa, Bihar, India, on sugar cane (C. S. Misra).

Family EURYBRACHYDIDAE.

Platybrachys Stål (?):

species (determined by O. Heidemann as *Eurybrachys*), Cairns, Queensland; *Deinelenchus australensis* Perkins (Perkins 1905) (Correction to Bulletin 66).

genus, new:

species, Queensland; July, 1904, *Megalechthrus tryoni* Perkins (Perkins 1905) (Correction to Bulletin 66).

HETEROPTERA.

Family PENTATOMIDAE.

Subfamily SCUTELLARINAE.

Chrysocoris Hahn:

grandis Thunberg, Siam, (received from F. Muir); (females) *Chrysocorixenos siamensis* Pierce.

Calliphara Amyot and Serville:

billiardierei Fabricius, (male and female) Amboina (F. Muir); (females and triungulinids); *Callipharixenos muiri* Pierce.

HYMENOPTERA.

Superfamily VESPOIDEA.

Family EUMENIDAE.

Eumenes Latreille:

fenestralis Saussure, Abyssinia, (female), (L. von Heyden 1867).

maxillosa DeGeer, (*tinctor* Christ), Abyssinia, (female), (L. von Heyden 1867).

flavopicta Blanchard, (determined by S. A. Rohwer) Larat, (females, males), (F. Muir), (females, male pupa, exuvium, triungulinids).

species No. 2, Larat, (male), F. Muir, (female, triungulinids).

species No. 3, Larat, (male), F. Muir, (female).

Odynerus Latreille:

chloroticus Spinola, Abyssinia, (female), (L. von. Heyden 1867).

(*Stenodynerus*) *toas* Cresson variety (determined by Rohwer), Albuquerque, New Mexico, (No. 2934), (male) *Pseudoxenos neomexicana* Pierce.

firmus Cresson (determined by Rohwer) Cedar Point, Ohio, June 19, 1913, (J. B. Parker), (female).

species, new, Tucson, Arizona, August 24, 1913, on cotton (W. D. Pierce), (females).

Family VESPIDAE.

Vespa Linnaeus:

acuta (sic) Germany (Ann. Soc., Ent. Fr., 1835, vol. 4, p. xlv.).

Vespula Thomson:

carolina Linnaeus (male), (determined by Rohwer), Clarksville, Tennessee, October 19, 1915, (S. E. Crumb), (puparium).

Polistes Latreille:

anaheimensis Provancher (male), (determined by Rohwer), Auburn, California. July 23, 1915 (L. Bruner), (female), *Xenos californicus* Pierce.

annularis Linnaeus 10. Louisville, Nebraska (7 females). August 2. 1914 (H. A. Jones, E. G. Anderson), (males), *Xenos pallidus* Brues.

11. Omaha, Nebraska (female), August 20, 1913 (L. T. Williams), (females), *Xenos pallidus* Brues.

12. New Orleans, Louisiana (Ed. Foster).

aurifer Saussure, (determined by Rohwer), Auburn, California (female), August 14, 1915, (L. Bruner), (female), *Xenos auriferi* Pierce.

bellicosus Cresson, Stone Cabin Cañon, Santa Rita Mountains, Arizona, August 24, 1913, on *Thurberia* (W. D. Pierce, (puparia).

canadensis Linnaeus, Paraguay, (Bohls), (male, female, triungulinids); *Xenos bohlsi* Hoffman.

crinitus Felton (*americanus* Fabricius). 3. New Orleans, Louisiana (Ed. Foster).

hebraeus Fabricius. 2. Pusa, Bihar, India, April 12, 1911 (G. R. Dutt), (female, males).

major P. B. (determined by Rohwer), District Federal, Mexico (J. R. Inda), (4 male exuviae, 4 male pupae).

minor Beauvais. New Orleans, Louisiana (Ed. Foster).

rubiginosus Lepeletier. 12. New Orleans, Louisiana (Ed. Foster).

variatus Cresson (determined by Rohwer), 4. Clarksville, Tennessee, November 10, 1915 (S. E. Crumb), (4 male exuviae). 5. Lanham, Maryland, November 24, 1915 (H. F. Loomis), (females, male pupa).

Meganthopus Ducke (*Polybia* Lepeletier):

flavitarsis Saussure, Stone Cabin Cañon, Santa Rita Mountains, Arizona, taken at its nest, August 25, 1913 (W. D. Pierce).

Superfamily SPHECOIDEA.

Family SPHECIDAE.

Sphex Linnaeus (Ammophila, Psammophila):

heydeni Dahlbom (Morice, 1913).

pictipennis Wahbom (determined by Rohwer), Falls Church, Virginia, August 14, 1914 (G. M. Greene).

tydei Guillon 2. (Morice, 1913).

yarrowi Cresson. Tucson, Arizona, August 24, 1913 (W. D. Pierce), (male, female).

Priononyx Dahlbom:

utrata Lepeletier. 2. New Orleans, Louisiana (Ed. Foster).

Ammobia Billberg. 1820 replaced *Proterosphex* Fernald 1905 according to S. A. Rohwer.

Family BEMBICIDAE.

Stizus Latreille (*Bembecinus* Costa, *Stizomorphus* Costa):

peregrinus Smith, Corcyra; *Paraxenos erberi* Saunders (S. S. Saunders, 1872) (correction to Bulletin 66).

ruficornis Fabricius (female) (determined by Rohwer) (*S. distinguendus* Handlirsch). Jericho, Palestine. April 3, 1909 (F. D. Morice, 1913).

species, (Perez, 1886) (correction to Bulletin 66).

species, Australia (Perkins, 1905, 91) (correction to Bulletin 66).

Bembix Fabricius:

species, Australia (Perkins, 1905, 91; 1906 in letter) (correction to Bulletin 66).

texana Cresson; New Orleans, Louisiana (Ed. Foster).

Family MUTILLIDAE.

Sphaerophthalma Blake:

fenestrata Lepeletier; New Orleans, Louisiana (Ed. Foster).

Family LARRIDAE.

Tachysphex Kohl:

maculicornis Saunders (female), Biskra, Algeria, June 19, 1907 (in Saunders Coll., Natural History Museum, South Kensington, England), (F. D. Morice, 1911, 1913).

Family PROSOPIDAE.

Palaeoriza Perkins:

eboracina Cockerell, Australia (Perkins, 1912).

turneriana Cockerell, Australia (Perkins, 1912).

Prosopis Fabricius:

mesillae Cockerell, Arizona (C. F. Baker 2522); Colorado (1414; 304 Metz).

Family ANDRENIDAE.

Nomia Latreille:

stylopicta Strand, Tanganika-See, Africa (Strand 1911).

Andrena Fabricius:

bisalicis Viereck (determined by H. L. Viereck) Alabama (female); *Stylops bisalicidis* Pierce.

bisalicis Viereck variety (determined by H. L. Viereck), Devils Lake (6 miles southwest), North Dakota, May 5, 1916, on Amelanchier (J. Silver) (female); *Stylops diabola* Pierce.

ceanothi Viereck (Trachandrena) (male), Montgomery County, Maryland, June 12, 1916, on *Ceanothus americanus* (J. C. Crawford); (male and female in copula).

cressoni Robertson, variety (determined by H. L. Viereck).

2. Ogden, Utah, May 16, 1915 (A. Wetmore), (female).

erigeniae Robertson.

3. (determined by J. C. Crawford), Plummer's Island, Maryland, March 29, 1915, on *Erythronium americanum* (J. C. Crawford) (females); *Stylops erigeniae* Pierce, type.

4. (determined by H. L. Viereck), Maryland, near Plummer's Island, March 21, 1915 (J. C. Crawford) (female), *Stylops erigeniae* Pierce.

5. (determined by H. L. Viereck), same place and date, on *Claytonia virginica* (Crawford, No. 4025) (female); *Stylops erigeniae* Pierce.

grandior multiplicatiformis Viereck (determined by H. L. Viereck), Big Fork, Montana, June 21, 1904 (females); *Stylops grandior* Pierce.

imitatrix fenningeri Viereck (determined by H. L. Viereck), Falls Church, Virginia, April 14 (N. Banks) (female).

imitatrix texana Cresson (determined by H. L. Viereck). 2. Texas (female).

medionitans Cockerell (determined by T. D. A. Cockerell), Florissant, Colorado, June 24, on *Cerasus melanocarpa* (T. D. A. Cockerell) (females); *Stylops medionitans* Pierce.

moësta Smith (determined by H. L. Viereck) (male) Govan, Washington, March 29, 1911 (J. A. Hyslop) (females); *Stylops moëstae* Pierce.

nasoni Robertson (determined by H. L. Viereck). 3. Maryland, near Plummers Island, April 16, 1916, on *Salix humilis*, H. L. Viereck (female).

neonana Viereck (paratype), Georgia (collection Philadelphia Entomological Society) (female); *Stylops neonanae* Pierce.

vicina Smith (determined by H. L. Viereck).

3. Plummer's Island, Maryland, April 20, 1916, on *Dentaria laciniata* (A. H. Pottinger) (females); *Stylops vicinae* Pierce.

4. Lahaway, Ocean County, New Jersey, on *Gaylussacia frondosa* (female and triungulinids); *Stylops vicinae* Pierce.

5. (determined by J. C. Crawford), Cabin John Bridge, Maryland, May 16, 1916, on *Barbarea barbarea* (A. H. Pottinger) (female), *Stylops vicinae* Pierce.

6. (determined by T. D. A. Cockerell) Salina, Colorado, April 14, on *Berberis repens* (W. P. Cockerell) (female); *Stylops vicinae* Pierce.

7. (determined by T. D. A. Cockerell), Boulder, Colorado, April 17, 1908, on *Crataegus coloradensis* (S. A. Rohwer) (female); *Stylops vicinae* Pierce.

8. determined by H. L. Viereck), Plummer's Island, Maryland, April 16, 1915 (J. C. Crawford) (females); *Stylops vicinae* Pierce.

Halictus Latreille:

sparus Robertson (determined by Crawford).

3. Vienna, Virginia, April 18, on *Salix tristis* (R. A. Cushman) (Crawford. No. 4592) (female).

4. Camps Springs, Maryland, May 11, 1916, on *Potentilla pumilo* (A. H. Pottinger).

Family PANURGIDAE.

Panurginus Nylander:

innuptus Cockerell, West Point, Nebraska, August 10 (male, female); *Crawfordia pulvinipes* Pierce (Pierce 1904 records as *Panurginus*, new species).

californicus Cresson (determined by J. C. Crawford), Los Angeles County, California (D. L. Coquillett) (females); *Crawfordia californica* Pierce.

Panurgus Panzer:

cavannae Gribodo, Jericho, Palestine, April, 1889; April 7, 1909 (Morice, 1913).

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Cites *Vespa acuta* and *Polistes gallica* as hosts of Strepsiptera.

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* 1913. Insects, Their Life Histories and Habits. Frederick A. Stokes, New York, pp. 46, 83, 188.

Refers to the family Stylopidae, Coleoptera.

BRUES, CHARLES THOMAS and MELANDER, A. L.

* 1915. Key to the Families of North American Insects. Rumford Press, Concord, N. H., pp. 2, 6, 10, 41, 42, pl. 8, figs. 169, 170, 171, 172, 175.

Only four families of Strepsiptera are given in the key for North America. The authors have reduced my superfamilies to families and include *Stylops* in the Xenidae. It would be impossible to run a male Strepsipteron to the order in the key to the orders on page 6. In description of plate 8 *Caenocholax* is placed in Xenidae.

CURTIS, JOHN.

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* Those marked with an asterisk have been examined by the author.

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FOWLER, WILLIAM W.

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Refers to *Stylops dalii* Curt. (p. 457, fig. 7), *S. kirbii* Leach (p. 457), *S. melittae* Kirby (p. 457, fig. 8), *Elenchus tenuicornis* Kirby (p. 458, fig. 9), *Halictophagus curtisii* Dale (p. 459, fig. 10).

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GROTE, AUGUSTUS RADCLIFFE.

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(This is a correction of the reference in Bulletin 66, p. 207.)

HANDLIRSCH, ANTON.

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* 1897. Imenotteri, Neurotteri, Pseudoneurotteri, Ortotteri e Rincoti Italiana, Entomologia, vol. 4, pp. 641–645.

Treats of Strepsitteri.

HOFFMAN, R. W.

*1913. Zur Embryonalentwicklung der Strepsipteren, Nachr. K. Ges. Wiss. Göttingen Math.-Phys. Klasse, 1913.

Gives the embryology of specimens from unknown host from Paraguay.

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1904. Ueber vivipare Insecten, Zool. Jahrb., vol. 19, pp. 458, 459, 461.

Refers to Strepsiptera. This is a correction of the reference in Bulletin 66.

HOULBERT, CONSTANT.

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INTERNATIONAL COMMISSION OF ZOOLOGICAL NOMENCLATURE.

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The commission is of the opinion that the original publication of *Trioxocera, Dioxocera,* and *Pentoxocera* make it evident that an error of transcription (seu transliteration) is present, and that these names be amended to read *Triozocera, Diozocera* and *Pentozocera.*

JACOBSON, GEORGE G.

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JEANNEL, RENE.

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EXPLANATION OF ILLUSTRATIONS.

C.=coxa.
E.=elytron.
em.=epimeron.
es.=episternum.
F.=femur.
H.=head.
hem.=hypoepimeron.
Mes.=mesothorax.
Mes. em.=mesoepimeron.
Mes. ep.=mesepimeron.
Mes. es.=mesepisternum.
Mes. sl.=mesoscutellum.
Mes. st.=mesosternum.
Met.=metathorax.
Met. em.=metepimeron.
Met. ep.=metepimeron.
Met. es.=metepisternum.
Met. pr.=metapraescutum.
Met. preal.=metaprealare.
Met. sl.=metascutellum.
Met. st.=metasternum.
P.=prothorax.
palp.=maxillary palpus.
pas.=parascutellum.
P. em.=proepimeron.
P. l.=postlumbium.
pr.=praescutum.
preal.=prealare.
psl.=postscutellum.
P. st.=prosternum.
pt.=pleurotergite.
sc.=scutum.
sl.=scutellum.
st.=sternum.
T.=trochanter.
W.=wing.
1st A.=first abdominal segment.
2nd A.=second abdominal segment.
9=ninth abdominal segment.
10=tenth abdominal segment.

PLATE 64.

Mengeoidea. Mengeidae.

FIG. 1. *Mengea tertiaria*, male, author's interpretation of Menge's drawing. 2–10. *Triozocera texana*, male, collected at light, at Victoria, Texas, July 4, 1908, by J. D. Mitchell. 2.—Venter of thorax, showing only basal portions of one wing and one of each pair of legs. 3.—Dorsal view of half of prothorax and mesothorax, with elytron removed, to illustrate protuberance over spiracle. 4.—Dorsal view of half of prothorax and mesothorax, with elytron in position. 5.—Ventral view of half of mesothorax showing spiracle and base of trochanter. 6.—Outline